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The decision of the Directors of the New York, New Haven & Hartford to allow holders of $185,200 of non-converted 4 per cent. debentures of 1908 to convert them into stock par for par—the privilege having expired April 1, 1903—opens some exceedingly interesting questions in railroad economics, policy and ethics; nor are the questions of principle less striking because the amount involved is small. It should be explained that the $185,200 of debentures are the non-converted remnant outstanding of a former issue of $16,000,000, and that the reasons urged effectively upon the directors were that sickness, absence from the country and accidents unforeseen and unavoidable prevented the offer of many of the $185,200 bonds in time for conversion. As New Haven stock now sells at about $200 a share the holder of one of these bonds now receives about 100 per cent. dividend as a gratuity which the corporation is in no wise legally bound to pay. Hence arise such questions as these: (1) Does or does not, in such cases, the principle of *caveat emptor* morally apply—in other words, is the holder of a convertible bond supposed to provide against accidents and contingencies and not provide for them at his own risk? (2) How about certain of the remnant bonds which have passed by purchase to secondary holders who thus become by pure luck the fortunate beneficiaries of a 100 per cent. dividend? (3) Should or can—in practice—the corporation distinguish, in justice to its regular share owners, between the primary and secondary holders of the debentures? (4) What effect as a precedent will such a policy have on a speculative value of railroad bonds not converted in time?—a question, by the way, somewhat pat to the New Haven Company, which is to convert $30,000,000 3½ per cent. new debentures into $20,000,000 of stock five years hence. (5) By parity of reasoning ought not a bondholder besides his 100 per cent. dividend now be given also the extra 4 per cent. a year on stock which he has lost since April, 1903, and (6) Is or is not the unique action of the New Haven Company evidence of a corporative soul as against the proverbial philosophy of the economists? Here are six basic questions, each with its *addenda*, which we cheerfully relegate to the large and thoughtful body of economists, statists, moralists and financiers. Not often in the fiscal annals of our railroads have they had just such a problem for analysis and solution.

The definite passing, last week, of the 4 per cent. dividend on the preferred stock of the company in which is lodged final control of the Rock Island and Frisco Systems, marks a distinct change in the financial and operating policy of the Rock Island management. The last four years' history of this 14,000 mile group of railroads is familiar enough to the readers of the *Railroad Gazette*. In the issue of December 1st last, the make-up and inter-relations of the two systems controlled by the Rock Island Company of New Jersey, on whose stock it is that the dividend has just been passed was fully described in the review of the several annual reports. The year's results were also examined in some detail. The gist of the situation is that the Rock Island Company, being in no way an operating company, depends for its income entirely upon dividends from its controlled properties. Its investment in $28,881,900 common stock of the St. Louis & San Francisco as yet returns no dividends, the Frisco having all it can do to pay 4 per cent. each on its first and second preferred stock and meet its guarantees on the Chicago & Eastern Illinois and other controlled lines. The one source for the $1,950,210 annual dividends which the Rock Island Company has been paying on its preferred stock has been the Chicago, Rock Island & Pacific Railway, which has been paying, since the present owners took control, 8 per cent. dividends on its stock, until the last fiscal year, when 6¼ per cent. was paid. This reduction in the Railway company's payments during the year ending June 30, 1905, as was shown in the review of the reports, cut down the Rock Island Company's income after fixed charges to within $61,000 of the sum required to pay 4 per cent. on its preferred stock, a margin quite too narrow for comfort. At the same time, the Rock Island Company's profit and loss surplus was reduced from the nominal figure of $50,779 on June 30, 1904, to $28,111 a year later. It was at once evident on publication of these figures that the Rock Island Company was sailing pretty close to the wind in making payments on its preferred shares; but the large increase in earnings reported by the Railway company in the late summer and fall months made it seem likely that unless there came a change of policy on the part of the management this preferred dividend would be continued. This in spite of the fact that it was plainly evident from an examination of results on the controlled railroad properties that business was not being handled anywhere nearly as economically as must be done if the roads hoped to approach the standard of other large railroad systems. In particular, the conducting transportation figure on all the lines was high, this one fact accounting for much of the disappointing showing in net earnings. The decision to disregard the interests of holders of the preferred stock of the New Jersey holding company is an important change in the previous policy of the present management. The funds which would otherwise have been paid over in dividends by the Railway company to cover the Rock Island Company's preferred dividend payments are instead to be turned back directly upon the lines of the Rock Island System in an extensive campaign of improvements which will involve a total outlay (including expenditures for equipment) of about $15,000,000. This, surely, is a step in the right direction; the one thing, in fact, which can bring about the ultimate establishment of Rock Island securities on something like the firm basis of the old Chicago, Rock Island & Pacific Railway Company's stock. If the Rock Island companies, in the recent fiscal year, when most other railroads in similar territory were returning great increases in both gross and net revenue, could not produce any more favorable results than they did, it is surely time for definite reforms. Part of the great potential value of these roads lies, of course, in the development of southwestern territory, where so much of their mileage is situated, but the im-

provement of the lines so as to bring them all up to somewhere near a uniform standard of efficiency is the most immediately important need.

FREE PASS EVILS AND BENEFITS.

In October, 1899, when an effort was made by Western railroad officers to do away with passes, we made the comment that agreements not to give passes were as fragile as agreements not to cut rates; that the country must wait until it had the agreement and co-operation of the railroads plus the co-operation of an enlightened public opinion expressed in effective laws. The 1899 effort failed. Again, in November, 1901, the Trunk Line presidents met and agreed not to exchange passes. The agreement went into effect January 1, 1902—and lasted about three weeks. In view of these modern instances—to go back no further than 1899—it is of interest to see wherein the present ban on free transportation differs in its chances of success from previous efforts in the same direction, and also to look at some of the uses and abuses of the pass, viewed as an institution. Our previous requirements of respective co-operation by railroads and public opinion and of effective laws seem now closer to realization, it is safe to say, than they have been at any time in the last generation. Therefore, the decision made by the Trunk Line officers last December to shut off passes entirely on the ground that they constitute discrimination in the eyes of the law, is supported at once by the weight of authority and by a public opinion which is not only alert, but considerably excited, on issues of corporate favoritism.

Roughly speaking, a railroad has four reasons for issuing passes, and practically all of the free rides granted can be attributed pretty definitely to one of them. The first of these reasons, and the one which is unassailable, legally or morally, is the benefit which the company derives from having certain persons use its lines freely. Theoretically, a railroad could require its officers, traveling on company business, to pay their fares out of a fund provided for that purpose, receipts and expenditures balancing each other on the books. In practice, this is not done, nor, so far as we know, has it ever been suggested that it should be done. But it is sometimes hard to determine the limits of this practice, for, apart from regular officers and employees, there are a number of other persons who serve the roads in a capacity more or less temporary, but are nevertheless useful with a use perhaps directly proportioned to the amount of traveling they do. Under this head cattlemen could be classified, together with special messengers in charge of fruit cars. An exchange of passes to permit employees of connecting roads to attend meetings and conventions is also an indirect application of the first reason, which has sometimes been temporarily discontinued, but seems to have sound justification in its general benefits to railroad practice.

Apart from this primary use for passes, they are issued in great numbers to bring, or to hold, business; to disarm hostility, and as a reward or compliment, in exceptional cases. Little need be said about the last mentioned use; it does not make much difference whether a railroad rewards conspicuous service, as for example that of the bystander who prevents a wreck by thinking and acting quickly, by a gift of money or by a gift of free transportation.

As a compliment, certain high British railroad officers receive from companies with which they are not connected, a gold medal which is good as a perpetual pass over the line issuing it; whether this constitutes discrimination or not, need not be considered at present; the British law courts apparently do not consider the custom offensive to the principles of equitable dealing set forth in the Railway Act. But the evil, the injustice, and the flagrant discrimination of passes is found under the second and third reasons mentioned for issuing them: the desire to get new business or hold old business, and the effort to disarm the hostility of legislators and others who have it in their power to make trouble for the road or not to make trouble for it, just as they please. The idea that passes might be given liberally without cost to a railroad is doubtless founded on the general principle that forty passengers can be carried in a car as cheaply as thirty-nine can; transatlantic steamship companies, which are strictly limited in their accommodations, and must make a positive outlay for food per passenger carried, have never made a practice of getting or holding freight shippers in this way. But the principle has been so extended through competition between roads that passes have not only become extremely expensive as a medium through which passengers are prevented from paying their fares, but, especially in the West, they have come to require positive expenditure on the part of the roads for equipment, fuel and service.

Every year new uses are found for passes as a means of getting business. Not long ago one of the New York suburban roads gave season passes to prominent doctors, in large numbers, evidently on the theory that a doctor pleased with his summer residence was a first-class, high-grade advertising medium. But the difficulty with expedients of this sort—entirely apart from the guilt of their discrimination—is that they are promptly neutralized by similar action by competing roads, after which the new crop of deadheads must be carried without profit or advantage by all alike, for it is much easier and safer to give a pass than to discontinue one. This neutralization of the expected benefits derived from pass giving is so general that it is almost comic. The spectacle of transportation worth thousands of dollars given to legislators, not by a single road to gain friends, but by all roads, to disarm enemies, is one of the ridiculous features that the pass situation has developed. From the standpoint of what is accomplished, it doesn't make much difference whether the state law requires or prohibits giving passes to legislators; from the standpoint of gross earnings, it makes a good deal. The legislators themselves are quite willing to submit to this sort of bribery, and the blackmail is very thinly disguised when the railroads take a stand against it. The plausibility of their resources is illustrated by a bill submitted to the New York State Legislature in 1897, which proposed that the Secretary of State should issue certificates to certain state officers to the effect that they were traveling on official business, these certificates to be accepted in lieu of passage money—this in direct violation of the constitution, which says that no public officer shall make use of any free transportation or accept any discrimination in passenger rates.

As has been said, the chances now seem better than ever before that at least some of this useless, extravagant discriminatory transportation can be cut off. Just where the line can be drawn between the legitimate free transportation which is a part of the working of the railroad as a machine and the illegitimate transportation outside, is not yet clear, but it is certain that there is a chance for much good to be done.

CAR BUILDING IN 1905.

The record-breaking car building returns for 1905 which were published in condensed form in our issue of December 22, disclose some interesting facts aside from the magnitude of the industry and the extraordinary demand for rolling stock which prevailed during the last half of the year and which promises to continue well into the coming year. After the inactivity which prevailed in 1904 none of the car building companies were prepared for the sudden increase in orders which began early in the summer, and the capacity of most of the larger plants was taxed severely to deliver the cars ordered. The small plants profited by the inability of the big builders to promise deliveries, and as a result many of them turned out more cars in the last five months of the year than in any previous twelve months. While the total output for the year was only about 3,500 cars more than in 1903, the output of the last four months far exceeded that of any similar period in years past. As indicating the present conditions, the order of the Southern Railway for 10,029 cars, which is noted elsewhere in this issue, is of interest. The first deliveries from any of the builders are to begin in March, and deliveries of steel gondolas by the Standard Steel Car Company are not to begin until October, 1906. It is safe to say that the output for 1906 will be close to 200,000 cars, if it does not exceed those figures.

There are at the present time eight plants in the United States equipped for building steel cars and cars with steel underframes. These plants turned out nearly 75,000 cars in 1905, or about 45 per cent of the total output, and of these 75,000 cars more than 60 per cent. were built entirely of steel. Assuming the steel bodies alone to weigh 10 tons each, this would indicate a consumption of 450,000 tons of plates and structural shapes. The cars built with steel underframes would increase this total to more than 600,000 tons. The shortage in finished steel products has helped to delay deliveries of cars of this construction.

It is only seven years ago that the first all-steel cars were built. The total number of these cars now in service is close to 150,000, or about 12 per cent. of the entire freight car equipment in the country. Nearly all of the steel cars are of 100,000 lbs. capacity, some few of 80,000 lbs. capacity having been built. So far only two large systems have adopted the 100,000-lb. box car as standard. The Harriman Lines have a large number in service which have been built within the last two years, and the Pennsylvania Railroad and Pennsylvania Lines West use 100,000 lbs. as the standard capacity for equipment for every class of freight service. Most roads, however, are building 80,000-lb. box cars with the American Railway Association standard dimensions, 36 ft. long, 8 ft. high and 8 ft. 6 in. wide

inside. These dimensions permit of loading only a few commodities to the amount of 90,000 lbs. or over in one car, which the 40-ton car, with 10 per cent. overload will carry safely. Only a small part of the box cars ordered recently have steel underframes. The small builders, who are not equipped for making steel cars, have been able to promise deliveries on wooden cars and have received the orders in preference to waiting for long time deliveries from the steel car builders. With proper body trussing and side framing a wooden box car of 80,000 lbs. capacity can be built as light and in most respects as strong as a steel underframe car. The wooden car is cheaper to build and to repair, and in these times of urgent demand for rolling stock a car can easily earn in four or five months' service enough to pay most of the difference in ultimate cost represented by the assumed longer life of the steel underframe car.

The use of pressed steel shapes is becoming less each year. Most of the steel cars built last year had structural steel underframes or sills built up of plates and angles. For small parts, such as side stakes, stake pockets, brake beams and the like, pressed steel shapes are quite generally used, but the waste of material in forming larger members and the difficulty of making repairs to pressed shapes have caused the practical abandonment of this construction. There have been few changes in the construction of wooden cars. More substantial body framing has been the general rule, light steel sections having been used in many cases in place of wood.

The numbers of each type of cars built during the year were about in the usual proportions of previous years, as the demand for rolling stock came from all parts of the country. The western roads ordered large numbers of box and stock cars, and the coal carrying roads in the East ordered a preponderance of gondola and hopper cars. The two largest single orders recorded, those of the Pennsylvania for 36,160 cars and the New York Central lines for 20,000 cars, were divided as follows: Pennsylvania, 20,860 gondolas, 5,000 hoppers, 8,900 box cars, 1,100 stock cars and 300 flat cars, all of steel or steel underframes and 100,000 lbs. capacity; New York Central lines, 9,000 gondolas and 10,000 box cars, with 1,000 miscellaneous cars. The Southern Railway placed orders during the year for more than 17,000 cars, of which about 5,500 were gondolas and 11,500 were box cars.

The 5,300 cars built for export were shipped to all parts of the world. Nearly half of those built were included in two orders, one from the Japanese Government Railway for 1,900 cars, and one from the Argentine Government Railway for 750 cars. Both of these orders were for narrow gage cars with steel underframes.

DISCIPLINE OF ENGINEMEN

It is against public policy—an injury to the people of the state—for a railroad superintendent to assign any other than the best man available to run the locomotive (or locomotives) of a fast express train; or to allow the officers of a labor union to bulldoze him into assigning members of the union to extra or irregular runs by some cast-iron rule which classifies all of the runners alike. (Classifying all alike always means lowering the best to the level of the poorest, for raising the poorest to the level of the best cannot be done by a stroke of the pen.) The foregoing is a pretty correct interpretation of the deliverance of the Grand Jury of Middlesex County, Massachusetts, in the matter of the disastrous collision of November 26. That paragraph, which looked almost like a secondary feature of the jury's report, was really of vital importance. As given in the *Railroad Gazette* of December 15, the paragraph referred to reads:

> If there is an agreement with the engineers whereby the first spare man on the list is to be assigned to the first vacant job, no matter what the character of the service required or the experience of the engineer, such an agreement is in violation of public policy and endangers the safety of the traveling public. The jurors find that no engineer should be permitted to work from 16 to 18 hours or more a day five days in succession.

And the last sentence, referring to long hours, is for practical purposes equally important. Neither statement condemns nor even criticises the practice of the road, and the public is left to guess how bad were the conditions discovered; but the admonition is weighty, as it is. Every superintendent knows the need of it—and knows how great is the firmness required to enforce the simple and reasonable regulations which are needed to prevent the abuses referred to. The newspapers say that the road in question has now ordered enginemen to be relieved after 11 hours and to be required to sleep at least six hours after 11 hours of service; an order which indicates that past practice has at least been unsatisfactory.

Both in maintaining the quality of his men and in regulating their hours of work the division superintendent has a task that is constantly difficult. It is impossible to assign the individuals of a list of, say, 20 extra runners, with a view solely to getting the best men for the most important trains or most difficult runs, without causing jealousies, if not acrimonious complaints. The selecting officer himself may exercise defective judgment, and the examiners who tell him how he must grade enginemen may do their work more or less imperfectly. For the first few years all enginemen are in some degree uncertain quantities; and on most roads this uncertainty is just now a constant factor by reason of the heavy traffic. Practically all of the extra men are pretty new; and it is with the extra men that most of the delicate questions of selection come up. In view of these difficulties it is a question whether there is any way to settle the problem except by maintaining a larger extra list, and, if possible, a better one. This, at any rate, is likely to be the only way for the perplexed general manager to look at it. If the division officer does not know how to secure good and satisfactory work with his present force, it is quite unlikely that his superiors can supply him with the knowledge.

The management of the hours of work is a simpler problem, if not an easier one. Hours must be made to conform to the same rigid rules, whether the force be large or small. Every time an officer consents to long hours because traffic is pressing and his force is too small, he is taking a definite risk, which is, indeed, "in violation of public policy." No road will ever be free from enginemen who are willing to work unreasonably long hours (catching naps while on duty, perhaps) for the sake of getting an unusually big check at the end of the month; and no manager will ever find it easy to repress trainmasters, despatchers and yardmasters who, when crowded with cars, will think that they can run risks of this kind without getting into trouble. This being the case, rigid rules are the only recourse. And it is futile to try to work all the time close to the limit. The Interstate Commerce Commission, in its accident regulations, inquires about men who work over 15 hours without 7 hours' rest; but that time-limit is a very liberal concession to the avaricious runner and the overzealous despatcher. Eleven hours' work, followed by six hours' rest, as in the rule mentioned above, is a much more reasonable limit. Even this last is, of course, far too hard a rule for regular service. We are not speaking now of what the human frame (and its firebox and boiler) can endure, but of what a general rule should prescribe. For regular service the thing needed is to adhere to the reasonable hours, similar to those for station and shopwork, which everybody is familiar with.

And this leads to a question which is really important, but which nobody seems to know how to grapple with, the irregularity of freight train men's hours. Could anything be more irrational than the universal practice of "running the rounds," under which no man ever knows three days in advance whether his sleep will come nights or days, whether the intervals will be long or short or alternately long and short? The utmost ingenuity could not devise a more perfect scheme for making work hours as bad and irregular as possible, than is now provided in the arrangements by which freight train men on most or all of the big railroads begin and end their trips. Whether it is the employers or the employees that are responsible for such a barbarous arrangement is of little moment; either party has the power to change it by united action. In war, or pestilence, or in emergencies at sea, it may be necessary for men to strain their bodies and their nerves to the limit of endurance, but what reason is there for it in the prosaic work of running freight trains? The fact that we ameliorate the strain as often as may seem requisite, does not relieve us from the responsibility for having imposed strains where there was no necessity for such an imposition.

A brotherhood cannot secure a change of the working-hour scheme to one which would be more conducive to health and normal mental conditions, without securing the co-operation of a large number of fellow-workmen. A railroad manager cannot make the change without either increasing his expenses or else forcing an unacceptable plan on a part of his employees. Neither party can be expected to do much, except as a result of a settled conviction that health of body and mind is an important element in a trainman's equipment. But none of these difficulties will serve as a full defense where a man kills passengers by sleeping at his post of duty. Neither is a superintendent excused for inaction because he cannot fully accomplish the object aimed at—because men neglect to rest when their work hours are reasonable and regular. The public means to hold a railroad up to the theory of doing the best that it can.

We have said that the higher officers of a road cannot instruct

a division superintendent in the delicate work of finding and promoting efficient men, nor in the violation of the seniority rule which is necessary in carrying out that idea. Neither can the manager put good backbones into superintendents who have poor ones. But he can establish high standards for his subordinates to live up to, and can greatly aid the superintendents to improve their backbones themselves, by assuring them that their work is so well appreciated that they are to be given full power and authority to continue a wise policy long enough to insure its success.

Summary of Annual Reports.

There are certain operating characteristics which vary greatly from year to year, such as the amount of business transacted, as shown by gross earnings, and the economy with which traffic is moved, as shown broadly by net earnings; while as a further commentary on net earnings the expense account shows whether the general tendency has been to improve the properties out of income, or whether retrenchment has been necessary. For the past two years the *Railroad Gazette* has illustrated these tendencies with diagrams made up from the composite figures of a large number of roads, believing that in this way the abnormal effect of special circumstances as affecting any one road or any small group of roads would be neutralized, and a pretty accurate picture would be presented of the railroad year in the country as a whole. The first diagram of this analysis is an enlargement of the one printed in our issue of January 13, 1905, and was made by taking the percentages of increase in gross earnings, operating expenses and net earnings of 17 large railroads, selected as being characteristic of conditions in all parts of the ocuntry. The increases are based on the year 1899 as a starting point, and the small figures under each ensuing year show the percentage of increase for each of the items, while the lines connecting these figures are intended to portray the same information in a graphic manner. The railroads which are included in this list are as follows: Atchison, Topeka & Santa Fé; Baltimore & Ohio; Chesapeake & Ohio; Chicago, Burlington & Quincy; Chicago & Northwestern; Chicago, Milwaukee & St. Paul; Cleveland, Cincinnati, Chicago & St. Louis; Erie; Great Northern; Illinois Central; Louisville & Nashville; New York, New Haven & Hartford; Norfolk & Western; Northern Pacific; Philadelphia & Reading; Southern, and Wabash.

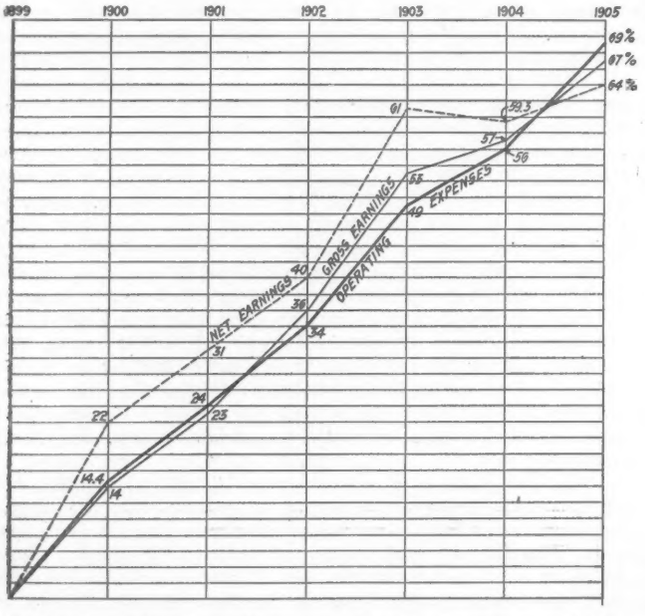


Fig. 1—Percentages of Increase Based on 1899—17 Roads.

The diagram needs no special explanation, and the curves show very clearly the steady increase in all three of the items from year to year, with the single exception of the year ending June 30, 1904, when net earnings decreased.

In making up the table this year it was necessary to approximate the figures for the Cleveland, Cincinnati, Chicago & St. Louis. All of the other roads were selected because they reported the fiscal year ending June 30, and in the previous comparison the same was true with the Big Four. This year, however, the time of its report has been changed to the fiscal year ending December 31. To get as close an approximation as possible in the figures used throughout this paper half of the year ending June 30, 1904, was taken together with the new figures for the half-year ending December 31, 1904, these being the last figures available. It is obvious, therefore, that the figures for this road are too small, and they would have been excluded except for the desire to retain the original group of roads in order that a continuous comparison might be made. It is fair to say that the difference between the assumed figures and the actual figures would not materially affect the curve after combination with the other 16 roads represented.

The most striking characteristic of the diagram printed last year was referred to as the struggle to reduce operating expenses, which increased at a more rapid ratio than gross earnings did. In 1905 this was also true, but the percentage of increase of gross earnings was so great that plenty of room was also left, in spite of the increase in operating expenses, for a substantial increase in net earnings not only over 1904 but over 1903, the previous high year. In 1903 net earnings were 61 per cent. greater than they had been in 1899; in 1904 they were 59.3 per cent. greater, and in 1905 64 per cent. greater. What these increases mean is well shown by a comparison with the actual figures for the 17 roads which make up the list, and which earned $457,272,272 gross in 1899, and $765,923,331 in 1905. They spent in 1899 $292,400,842 as operating expenses, and in 1905 $494,970,074; and they earned net $164,851,430 in 1899 and $270,953,258 in 1905. By way of making a uniform comparison, net earnings are given in the way they are most commonly reported; that is to say, without deducting taxes. Whether or not taxes are deducted does not affect the curve at all, so long as the practice adhered to is uniform.

It will be observed that in spite of the downward curve of net earnings last year, and in spite of the extremely satisfactory results in 1905, this year is the first one in which the curve of gross earnings and operating expenses crosses that of net earnings. The obvious reason for that is that with very great increases in gross the roads still had room to increase their operating expenses largely and leave sufficient net earnings for dividend and surplus purposes. The way these gross earnings were used is shown very clearly in the following table, based on the expense account of 19 railroads, substantially the same as the 17 used in compiling Figure 1, but including one or two others which were not available for a six-year comparison.*

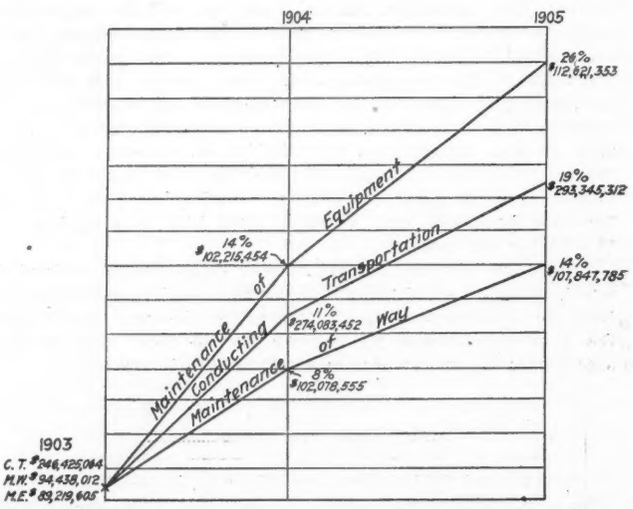


Fig. 2—Percentages of Increase in the Expense Account—19 Roads.

This table shows some remarkable and very unusual results. It will be recollected that throughout 1904, particularly in the early months of the year, great efforts were made at retrenchment by all roads. The effects of this were not especially apparent last year, for when the average is based on a large number of roads it takes some time for tendencies to appear. In 1904 the cost of conducting transportation on these roads increased 11 per cent. over this item in 1903; but in 1905, in spite of the tremendous traffic increases, cost of transportation only increased 7 per cent. over 1904, or 19 per cent. over 1903. The diagram to illustrate these results (Fig. 2) shows clearly where savings can be made in the expense account, when economy is necessary, and where money is spent freely, when economy is not necessary. In the year ending June 30, 1904—the economy year—with all expenses cut as low as possible, the increase in the charge for maintenance of way and structures was only 8 per cent., and the companies were so slow in starting new work after the close of the retrenchment period that the charge under this head increased only 5 per cent. from 1904

*These roads are as follows: Atchison; B., R. & P.; B. & O.; C. & O.; C. & N. O.; C. & A.; C., C., C. & St. L.; C., M., & St. P.; C., R. & Q.; D. & R. G.; Great Northern; I. C.; M., K. & T.; New Haven; New York Central; N. & W.; Rock Island; Southern Pacific; Wabash.

to 1905, or 13 per cent. from 1903. Maintenance of equipment, however, is an item that cannot well be even temporarily reduced, except for certain special work that does not total up large. It will be seen that this charge increased 14 per cent. from 1903 to 1904, and 10 per cent. from 1904 to 1905, or a total of 26 per cent. over 1903, in the two years. With the increases in large locomotives, it is evident that this charge must continue to remain constantly high.

It is unfortunate that one of these curves—that for the conducting transportation charge—is not based on the proper fiscal

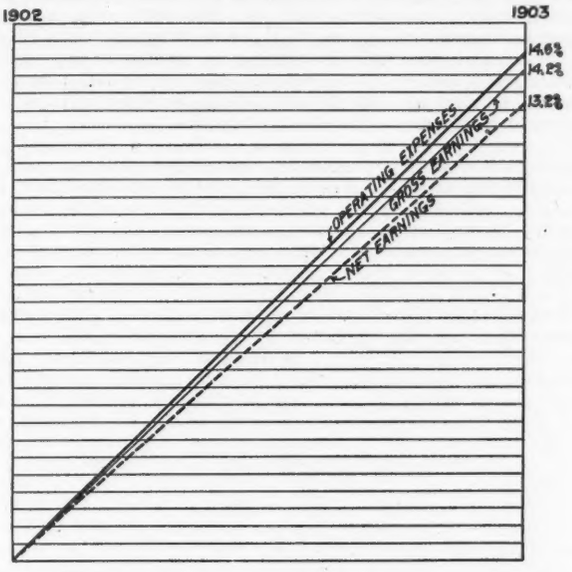


Fig. 3—Percentages of Increase. Years Ending Oct. 31, 1902 and 1903—101 Roads.

period to show the savings recently made. Continued care in operation, unprecedentedly large train loads and a lower fuel cost are now causing excellent economies, and these may be expected to show more plainly in the record a year from this time.

Figure 3 is a diagram which we have constructed from the totals of figures prepared by the *Commercial and Financial Chronicle*, as in previous years. The *Chronicle* bases its figures on current reports of earnings, and can use only those it receives from the

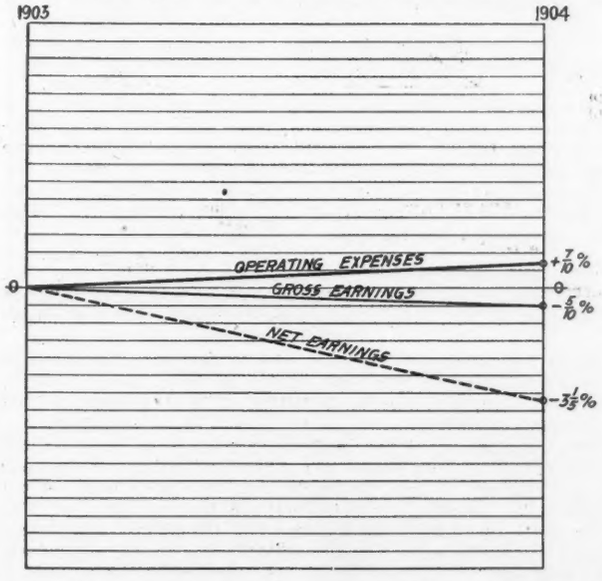


Fig. 4—Percentages of Change, Years Ending Oct. 31, 1903-04; —95 Roads.

roads prior to the publication of the annual reports. The number of roads making these reports varies. Last year 95 were reported; in 1903, 101, and in 1905 only 91. Therefore, no effort has been made to plot the curve for several years on the same diagram, since the properties from which the figures are made up are not constant; but in each case a comparison of precisely the same roads is made through the same ten months of two fiscal years. Thus the current diagram shows how gross earnings, operating expenses and net earnings for the ten months ending October 31, 1905, compared with the ten months ending October 31, 1904. Figures 4 and 5 make precisely the same comparison, only with a slightly different number of roads four years preceding. In each one of these three ten-month diagrams the increase in operating expenses has been the greatest of the three items presented. This year the three increases are all quite close together. Last year, as a result of radical efforts, the increase in operating expenses was cut down to .7 of 1 per cent., and yet both gross earnings and net earnings decreased.

The last table in the paper, comparing train loads through the last five years on 17 roads, which represent practically all parts of the country, is very striking. The figures exclude company's freight, except in one or two instances where no separation was made in the report, and where it is possible that the load is not strictly a revenue one. It was natural enough that in 1904, a retrenchment year, train loading could not be very materially improved; for, in spite of the economy of good loading, there are only a few roads, like the Great Northern, that can effect this by management alone without the aid of heavier equipment, and in 1904 the amount of new equipment was considerably smaller than it was this year. In 1905 five roads made the remarkable showing of an average revenue train load of over 500 tons. These were the Chesapeake & Ohio, 557; the Great Northern, 523; the Union Pacific and the Buffalo, Rochester & Pittsburg, 507 each; and the Lehigh Valley, 501. The Pittsburg & Lake Erie, with its average loading of over 900 tons, is intentionally omitted from the table, as its traffic is so highly specialized that the figure affords no comparison with roads doing a general business. Last year only one road of the group, the Chesapeake & Ohio, had an average loading of over 500 tons.

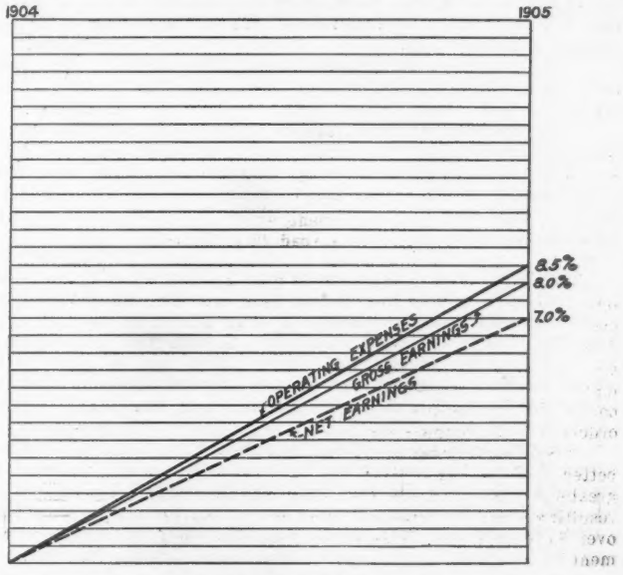


Fig. 5—Percentages of Increase, Years Ending Oct. 31, 1904-05; —93 Roads.

In 1903 this loading was not reached by any road reported in the group, although the Chesapeake & Ohio had respective loads of 508 and 511 tons in 1902 and 1901. The average loading of the 17 roads was 376 in 1905 as against 356 in 1904, the largest increase which has occurred in any of the five years reported.

Revenue Train-Loads; Tons.

	1905.	1904.	1903.	1902.	1901.
Atchison, Topeka & Santa Fe	282	269	279	247	242
Baltimore & Ohio	399	401	416	406	381
Buffalo, Rochester & Pittsburg	507	439	441	424	406
Chesapeake & Ohio	557	508	493	508	511
Chicago & Alton	347	336	356	316	288
Chicago, Burlington & Quincy	327	278	266	218	201
Chicago, Milwaukee & St. Paul	265	245	244	254	236
Erie	412	409	406	376	375
Great Northern	523	447	446	417	381
Illinois Central	319	278	288	275	235
Lehigh Valley	501	486	485	467	467
Minneapolis, St. Paul & S. Ste. Marie	309	301	305	315	314
Northern Pacific	367	339	344	346	324
St. Louis & San Francisco	200	198	195	187	200
St. Louis Southwestern	267	388	384	344	318
Union Pacific	507	451	403	418	365
Wabash	299	286	302	285	283
Average for 17 roads	376	356	356	341	325

Railroad Officers on the 1906 Outlook.

We have made it a custom for several years to send circular letters to the principal executive officers of the most important railroads in the country at this time, asking them for an expression of opinion, as specific as possible, about the outlook for traffic in the year to come. We agree in writing these letters not to disclose the identity of those who answer, in order to secure as frank an expression of opinion as possible. The following quotations are

taken from answers received to these letters, classified by the sections of country from which they came.

CENTRAL ROADS.

"The present business conditions at points on our lines as indicated by traffic returns are somewhat higher than they were a year ago, and the outlook for the immediate future at least is favorable. The indications are that shipments of iron will be as large during the coming year as they have been during the past one. We think the grain movement will also be as heavy in 1906 as it was in 1905, and unless signs fail shipments of flour will be larger."

President.

"The business conditions in the territory through which this road passes are much more favorable for 1906 than during the two previous years. During 1903-1904 the crops along the line were poor, but this year they have been far above the average and the crops in the territory west of the Missouri river, especially the corn crop, are much larger than in the two previous years. The same is true of the territory west of St. Paul and Minneapolis. We are preparing to try the experiment of building freight cars. We shall start in slowly, calculating to build about 15 or 20 a month."

President.

"Our impressions are that the business conditions in the territory through which this road passes are considerably better than they were a year ago and decidedly better than in 1903. We will probably spend 10 millions or 15 millions for construction work, and we expect to order 100 locomotives."

General Manager.

"Business conditions as compared with last year and the year before are much better. Good crops and activity in all industrial lines are responsible for this result. We will order about 55 locomotives and 3,600 cars." *President.*

"The business conditions in the territory served by this company are excellent, and are as good if not better than in any previous year." *President.*

"The business conditions are favorable to an increased heavy tonnage occasioned by the great demand for iron, coal and coke. We will probably order 50 heavy freight locomotives and 4,300 freight cars during the year, and we expect to spend about $925,000 on new shops and shop equipment, about $825,000 on bridges, and about $2,000,000 on permanent road improvements."

President.

"My impression of the general business conditions of the territory traversed by this line is that they are better than they have ever been. The specific indications that will affect earnings are, first, the general business prosperity; second, the great demand for manufactured articles, and, third, a full crop of grain to be moved, coupled with the good foreign demand. During 1906 the company will receive 6,700 freight cars and has already placed orders for 100 locomotives." *President.*

"General business conditions in our territory seem to be much better than at the same time last year. Orders are on hand in greater number and the only drawback in sight is the restriction resulting from shortage of cars. We expect to receive something over 2,000 cars next year, which will practically double our equipment." *General Manager.*

EASTERN ROAD.

"Every kind of business throughout the section of the country served by this company is apparently more prosperous than at any corresponding period during the last five years, and we see nothing in the outlook, other than possible radical action by Congress at the present session, which seems likely to disturb these present conditions of prosperity. We have 36 first class locomotives under contract for delivery between now and the first of next May; also 2,000 freight cars under contract, with the prospect of 4,000 more, if we can get them built within the next 12 months."

President.

WESTERN ROADS.

"I consider the business outlook for 1906 to be the best that this country has ever had. We have raised a good crop and our territory is settling up fast, which necessarily makes business. We have contracted for 16 locomotives and will buy 1,500 box cars."

Vice-Pres. and Gen. Mgr.

"My impression of the business conditions in the territory through which this line passes is favorable. From all the indications before us, traffic next year should show an increase over the present year and the year preceding, so far as freight is concerned. Earnings the coming year will probably be affected by the lower rate brought about by competition between the Gulf lines and those reaching the Atlantic Seaboard. The only cloud on the horizon is the possibility of hostile legislation, both Federal and state, which would in itself have a very serious effect on the railroad interests in this section of the country. We have ordered 25 locomotives, 1,000 box cars and 300 stock cars, and will probably order 250 more box cars in the coming year. Our construction expenditures will probably amount to two and one-half or three million dollars." *President.*

SOUTHERN ROADS.

"My opinion of the business conditions of the territory through which our road passes as compared with those of last year and the year before is that, being a new line in territory hitherto untouched by railroads, we will show an extremely large increase. Our tonnage is largely forest products and at the present time the market for these is extremely good and likely to continue so. The probabilities are that we will make heavy expenditures for both motive power and equipment."

Vice-Pres. and Gen. Mgr.

"There is every indication of an increase in business, caused by the general prosperous condition of the country and the new acreage that has been set out on our line. Our traffic consists largely of fruit and vegetables, and while it is almost impossible to undertake to say just what returns will be, on account of the various uncertainties entering into farming operations, we feel that it is fairly safe to prophesy with the new acreage set out that there will be a considerable increase for the coming year."

President.

"At present we are inclined to believe that business will be generally better next year than in 1904, and expect some slight improvement over 1905, which has been our best year for tonnage handled. We can see no specific reasons at present which should affect our earnings next year. This, of course, could be affected by possible labor troubles, which are, however, not apparent at present."

President.

"The territory through which our road passes is showing steady growth. Each year there is a decided improvement in our business over the preceding year, and I consider the outlook in our territory for continued growth bright. I have no specific causes to give for this growth except the development of this whole section of the South in all lines." *President.*

"My impression is that business conditions in the territory served by our lines are certainly as good and probably better than they were a year ago. At present there is a shortage of cars which has restricted the amount of business handled to some extent. Our gross earnings for the fiscal year so far are a little in excess of those for last year, and I see no reason why they should not be equal to or better than they were last year from now until June 30th."

President.

"Business conditions throughout the South along our line were never in better shape than at present. The only specific item of traffic which would be apt to affect our earnings during the coming year is lumber. This is moving in greater volume than at this time last year and every indication points to a continuance of these conditions. The movement of general traffic of every character is good." *President.*

SOUTHWESTERN ROADS.

"It is pretty early to form a correct opinion as to the business conditions for 1906, but we look hopefully forward to a continuance of the present prosperity throughout all of our country."

President.

"The outlook for this year is very good. There are no specific indications likely to affect the earnings in this territory for 1906."

President.

"The business conditions of the territory through which our road passes are quite as favorable if not more so than at the same time last year and the year preceding. The future outlook is quite bright because of the increasing developments in the mining districts served, and particularly owing to the prospect of additional land which will be put under irrigation by the building of the United States Reclamation Service dams and irrigation systems."

Asst. to President.

"The business of this company has been much better this year. I cannot name any specific indications which are likely to affect our earnings in 1906, except perhaps an increase in cotton acreage."

Vice-Pres. and Gen. Mgr.

"I do not anticipate that there will be any material change in business conditions on this road during the year, except possibly a decrease in its earnings due to falling off in oil shipments from the Humble oil fields." *President.*

"Our impression of the business conditions of the territory through which this road passes as compared with those at the same time last year and the year before is that there is an improvement in every way. Specific indications that are likely to affect earnings in our territory during 1906 are found in the almost phenomenal settlement of the country through which the line passes, particularly at the west end."

Vice-Pres. and Gen. Mgr.

CANADIAN ROADS.

"The business conditions of the territory through which this road passes are quite as favorable as for the same period last year, while the larger grain crop of the season should insure even a better movement. It is too early to determine fully upon our budget for the ensuing year, but we intend not only to continue to fully maintain our properties but to keep up the same ratio of general improvements in all directions."

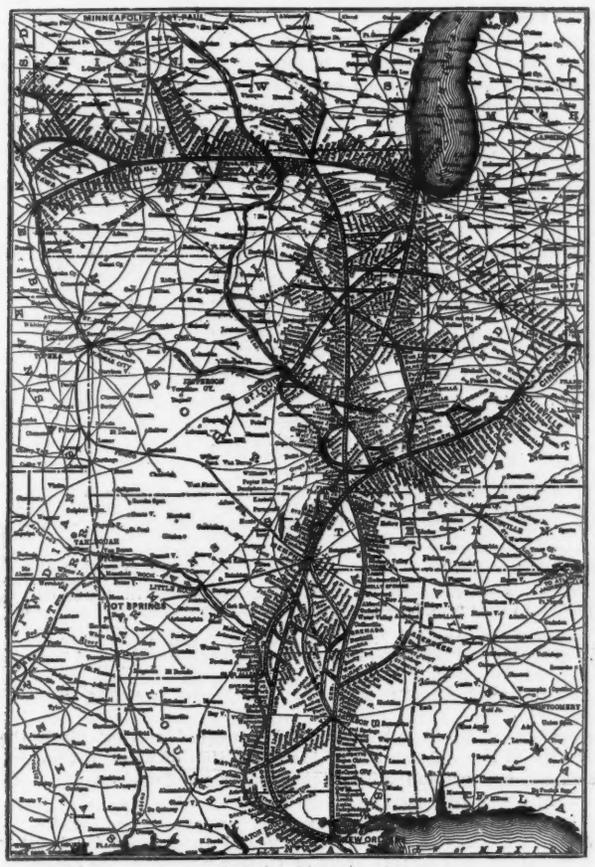
General Manager.

"The business conditions in our territory appear to be somewhat better than they were at this time last year and the year

before, and I have no knowledge of any specific conditions likely to affect earnings, except that I understand that the shippers generally are preparing for a somewhat increased output of pulp wood, lumber, etc." *Vice-Pres. and Gen. Mgr.*

Illinois Central.

For many years there was no more common axiom of railroad finance than that north and south lines were not profitable and that the only successful railroads were those running east and west. For many years also, the Illinois Central stood out as the exception which proved the rule. To-day, with the old axiom thoroughly disproved and a rapidly growing realization on the part of railroad managers all over the country of the coming importance of the gulf export trade, the Illinois Central with its water grade line down the Mississippi river and its dominant position at the most important gulf port, is one of the most immediately and potentially valuable railroad properties in the country. Besides having the most direct line between Chicago and New Orleans, most of it double track or with alternate routes, supplemented by extensive systems of branches and feeders, the Illinois Central has for the present another advantage over all the other north and south lines.



Illinois Central.

It is itself a granger line. From points on its own line extending west through Iowa as far as Albert Lea, Minn.; Sioux Falls, S. Dak.; Sioux City, Iowa, and Omaha, Neb., it can carry export grain all the way to the gulf over its own rails and secure the whole of the 1,200 to 1,300-mile haul. This, too, without having to bring the grain into the congested territory about Chicago.

Even on grain for export via the gulf coming over other lines, the Illinois Central gets by far the larger part of the haul. For example, on tonnage moving by the recently announced cut in grain rates from Omaha to New Orleans by the Chicago & North-Western, the North-Western gets a 392-mile haul from Council Bluffs to Dixon, Ill., against the 914-mile haul of the Illinois Central from Dixon to New Orleans. This illustrates pretty clearly the advantage which accrues to the Illinois Central on the rapidly developing gulf export business.

The financial history of the property is a brilliant one. During the past year came the one hundredth semi-annual dividend on its stock, celebrated by the declaration of an extra dividend, which though still continued as an "extra," practically raises the rate to 7 per cent. At the last annual meeting President Fish addressed the stockholders on the growth of business since his first election in March, 1877, as a director of the company. At that time commercial and financial conditions were at a very low ebb, and especially was this true of railroads. The shares of the Illinois Central sold in April, 1877, at the lowest price ever known, $40.50 per $100 share. Their price was particularly affected by the failure in both Illinois and Iowa of the crops of the year before, 1876; by uncertainty in the minds of the investing public as to whether the company could recover the advances which it had made to the Mississippi Central and the New Orleans, Jackson & Great Northern Railroads, and by doubt as to whether, having through foreclosure reduced those properties to possession, they could be made to earn an adequate rate of interest, or indeed any interest, upon the capital invested; and by the enforced reduction in 1877 of the dividend rate from 8 per cent. to 4. At that time British and Dutch proprietors owned more than four-fifths of the entire capital.

Mr. Fish, after remarking that to-day more than four-fifths of the company's capital is held in the United States, presented a statement showing the changes which have taken place in the intervening 28½ years. This statement was prepared with the particular idea of selecting the items of the company's business bearing directly upon its relations to the public which it serves and to those in its employ: Namely, the gross receipts from traffic—that is, the money collected from the public, from other railroads, from the express companies and from the carriage of mail—and the use made thereof; the number of persons employed, the amounts paid them, the proportion which such payments bear to the gross receipts, and the average yearly wages of employees; together with a comparative statement showing for each of the years named not only the service rendered, but the service rendered per mile of railroad operated; that is, the density or intensity of the service. The statement follows:

Comparative Statement Showing for 1876 *and* 1905, *the Gross Receipts and the Use Made of Them.*

	Calendar year ended Dec. 31, 1876.	Fiscal year ended June 30, 1905.
Gross receipts	$7,040,969	$49,508,650
Operating expenses and taxes: Amount	4,270,205	35,111,706
Per cent. of gross receipts	60.65%	70.92%
Earnings from operation :* Amount	2,770,764	14,396,944
Per cent. of gross receipts	39.35%	29.08%
Fixed charges, inc. int., rent & sinking fund	1,242,780	7,023,109
Av. rate. pr annum of int. on funded debt	5.44%	3.78%
Per cent. of gross receipts	17.65%	14.19%
Leaving applicable to dividends: Amount	1,527,984	7,373,835
Per cent. of gross receipts	21.70%	14.89%
Dividends actually paid: Amount	2,320,000	6,652,800
Rate per cent. per annum	8.0%	7.0%
Per cent. of gross receipts	32.95%	13.44%
Number of employees	4,573	31,223
Wages of employees: Amount	$2,548,047	$20,902,737
Per cent. of gross receipts	36.19%	42.22%
Av. yearly wages each person employed	$557.19	$669.47

*Being excess of gross receipts over operation expenses and taxes.

On Sept. 1, 1876, a scaled reduction in pay of all officers and employees went into effect, ranging from 5 per cent. to 25 per cent.

Since 1876 the capital stock has been increased from $29,000,000 to $95,040,000 by the payment into the treasury of the company of somewhat more than $66,040,000 in cash. Every dollar of this additional capital has been offered to all stockholders for subscription at the same price, in no case less than par, without the intervention of any syndicates or underwriters. In addition to which, $32,994,878 has in the meanwhile been taken from moneys properly applicable to dividends, for the betterment of the property and the creation of various funds, including one for pensions.

The annexed table shows for the two years in question the service rendered to the public:

Comparative Statement Showing for 1876 *and* 1905 *the Service Rendered the Public.*

	Calendar year ended Dec. 31, 1876.	Fiscal year ended June 30, 1905.	Increase in 1905 over 1876.	Per cent. of service rendered in 1905 to that in 1876.
Pass'gers carried 1 mile	51,258,031	583,481,895	532,243,864	1,138.77%
Tons freight car'd 1 mi.	264,602,314	5,559,139,454	5,294,537,140	2,100.94%
Units of service.*	315,840,345	6,142,621,349	5,826,781,004	1,944.85%
Miles, railroad operated	1,107.66	4,373.91	3,266.25	394.88%
Units of service, pr mile	285,142	1,404,378	1,119,236	492.52%

*Being the sum of the passengers and tons of freight carried one mile.

Mr. Fish then said that in considering the increase of service rendered it must be remembered that at the end of 1876 the Illinois Central had been operating the whole of its lines in Illinois for 20 years, and the lines in Iowa for more than nine years, and that the railroads which have since been taken over and are now operated are of much later construction, besides having had, when taken over, a comparatively light traffic. That is to say, the increase in the density of service rendered on the old lines in operation in 1876 has been much greater than appears from the statement, which includes all lines now operated. Yet, taking results as they stand, it is shown that during the last fiscal year the company rendered to the public with respect to each mile of railroad operated a service which is 492.52 per cent. as intense as was the service rendered in 1876, while the volume of service rendered has increased in respect to passengers carried one mile 1138.77 per cent.; in respect to tons of freight carried one mile 2100.94 per cent., and in respect to units of service performed more

than 1944.85 per cent. Mr. Fish said that in view of the criticism of railroads for failing to perform their duty toward the public, he wished thus to demonstrate to the owners of the property that the Illinois Central has done and is increasingly doing its duty to the public; a fact which, he added, he believed is appreciated in the territory served by the company in which so many of the stockholders live.

This statement of the President's shows graphically the wonderful growth of the last quarter of a century. Results for the past fiscal year show a similarly favorable record. With an increase of only 34 miles in the average mileage operated, gross earnings increased $2,677,514; operating expenses only $291,000, and net earnings $2,386,507, or 17 per cent. over 1904. Taxes, which amounted to $2,027,448 (the Illinois Central owing to the provision in its charter by which it turns over 7 per cent. of its gross earnings in Illinois to the state, has an unusually heavy tax charge) and fixed charges brought down the $16,424,392 net earnings to $10,135.342, the net income for the year. This is equal to 10.66 per cent. on the stock. From this, $6,652,800 was paid as a 7 per cent. dividend on the stock; $1,255,396 was subtracted as discount on bonds sold; $500,000 was added to the insurance fund, and $1,683,886 was set apart for betterments, leaving in the surplus dividend fund at the close of the year, $1,269,027.

One disastrous event of the year was the fire of Feb. 26, 1905, which destroyed the Illinois Central elevators, warehouses and other facilities at the Stuyvesant Docks, New Orleans. As these were the property of the Yazoo & Mississippi Valley, which, with its 1,175 miles of line, makes returns as a separate corporation, the direct loss to the Illinois Central was principally in the destruction of 233 freight cars, a money loss of $87,250, which was charged to the insurance fund. The Yazoo & Mississippi Valley's losses were $1,095,729 on account of structures and $32,730 on account of freight cars; a total of $1,128,459. Of this, $935,682 was charged to the Yazoo & Mississippi Valley insurance fund, the remainder, representing depreciation, to be charged to repairs and renewals as the work of rebuilding progresses. To the insurance fund was credited $1,201,259 altogether, of which $655,643 represented the Yazoo & Mississippi Valley surplus for the year, and $545,616 was, instead of being paid to the owners of the second mortgage bonds of the Louisville, New Orleans & Texas, as ordered by the Board of Directors at the close of the fiscal year 1904, with the assent of the holders of all such bonds, transferred to the Y. & M. V. insurance fund.

During the year the Illinois Central took steps to acquire its own line into the city of Indianapolis. The Indianapolis Southern, a railroad which was being built from Indianapolis to Switz City, Ind., the terminus of the Illinois Central's Effingham branch, and was projected to run westward paralleling that branch into the coal fields of Sullivan County, Ind., was acquired, and track has now been laid on more than half of the line into Indianapolis, giving the Illinois Central shortly its own line into that city.

A similar reaching out to the eastward since the close of the fiscal year was the purchase of the Tennessee Central by the Illinois Central and the Southern Railway. On the partition of the Tennessee road, the Illinois Central obtained the western end, giving it its own line from Hopkinsville, Ky., the terminus of one of its branch lines, into Nashville, Tenn.

A policy long in vogue on the Illinois Central is that of steadily improving the standards of maintenance. During the past year the average weight of rail in main track increased from 72.78 lbs. to 73.50 lbs. Similarly, the average tractive capacity of locomotives on level track increased from 3,724 tons to 3,860 tons; and the average capacity of revenue freight cars from 33.77 tons to 34.21 tons. The steady application of this policy through a series of years is clearly shown in the high points which these different figures have already reached.

The operating statistics show an increase of $1,175,000, or 12.3 per cent. in passenger earnings, against an increase of $915,347, or 2.9 per cent. in freight earnings. The operating ratio, excluding taxes, decreased from 70 per cent. in 1904 to 66.8 per cent. in 1905. Maintenance of way increased $415,785; maintenance of equipment $481,467, and conducting transportation decreased $683,887; a fine record of operating efficiency. The largest increase in maintenance of way came in the three items, renewals of rails, renewals of ties and repairs and renewals of bridges and culverts. In maintenance of equipment the increase in repairs and renewals of freight cars was larger than the total increase in equipment maintenance. On the other hand, there was a reduction in freight train expenses of $777,740, larger than the total reduction in conducting transportation account. The reduction of 3.64 per cent. in conducting transportation expenses is particularly favorable in view of the 338,000,000 more ton-miles and 98,000,000 more passenger miles than in 1904.

Other figures show operating efficiency in other ways. The average number of freight cars in a train increased from 24.44 to 26.19; the average revenue train load from 278 tons to 319 tons—a notable increase in view of the large amount of high class and perishable freight, such as bananas and domestic small fruits, which the road carries. The train load, including company freight, was 367 tons. The average number of passengers in a train increased from 43 to 50, or 16.7 per cent. Net receipts per mile of road clearly reflect this efficient handling of traffic. With an increase of $529 per mile in gross earnings, net earnings show an increase of $520 per mile, or only $9 out of $529 per mile used in increased operating expenses. Maintenance of way per mile increased from $1,308 in 1904 to $1,393 in 1905. Repairs and renewals cost $2,211 per locomotive in 1905 against $2,458 in 1904; $786 per passenger car in 1905 against $688 in 1904; and $68.50 per freight car in 1905 against $61 in 1904. These are all liberal maintenance expenditures for the road. A particularly valuable statement in estimating the value of the equipment is a comparative statement showing the number of locomotives and the years in which they were built, an exhibit which would be received with great interest from certain roads whose record is not so clear as is the Illinois Central's in this respect.

The results shown in the report make it clear that the directors took no extreme step in declaring the two successive extra dividends. Except for the unusual conservatism for which the Illinois Central management is noted, the showing of the road would fairly justify an out and out declaration of the flat 7 per cent. rate, a step which it is not unlikely will soon be taken.

The Yazoo & Mississippi Valley shows gross earnings of $8,670,245 against $7,868,335 in 1904, an increase of 10 per cent. Net earnings were $2,281,271, an increase of 8 per cent. The average revenue train load was 246 tons, which is almost the same as the 1904 figure. The gross earnings per mile of road increased $494 per mile, or 7 per cent.; but $400 per mile of this amount was absorbed by operating expenses, leaving net earnings per mile of road $1,895, an increase of $93 per mile of road over the preceding year.

The principal statistics of operation for the Illinois Central proper are tabulated below:

	1905.	1904.
Mileage worked	4,374	4,340
Freight earnings	$32,607,922	$31,692,575
Passenger earnings	10,729,825	9,554,743
Express earnings	1,002,154	854,246
Gross earnings	49,508,650	46,831,136
Maint. way and structures	6,095,096	5,679,311
Maint. of equipment	7,804,810	7,323,343
Conducting transportation	18,102,052	18,785,938
Operating expenses	33,084,258	32,793,251
Net earnings	16,424,392	14,037,885
Gross income	52,270,157	49,547,685
Net income	10,135,342	8,865,927

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3⅝ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Lock Joint Pipe.—An illustrated pamphlet setting forth the superiority of lock joint pipe for the protection of piles in wharves, warehouses, trestles and other structures is published by the Lock Joint Pipe Co., New York.

Fans and Blowers.—Fans, blowers and exhausters for heating and ventilating, mechanical draft and other purposes, are described in a booklet issued by the Green Fuel Economizer Co., Matteawan, N. Y.

CONTRIBUTIONS

Walschaert Valve Gear in Service.

Philadelphia, Pa., Dec. 27, 1905.

To the Editor of the Railroad Gazette:

Motive power men who are now waiting for the first reports on Walschaert valve gear service will be interested to receive some advance information as to the general satisfaction of this gear now in use on the Pennsylvania Railroad. This road has practically been the pioneer in its use in this country, and the average railroad man has been rather skeptical about the success of such a radical departure from the standard type of valve motion. Although it is realized that the Walschaert motion has proved successful, after many years of service on the other side of the water, yet foreign conditions of train tonnage and service are not those found in this country, so that the call has been for American results.

The first Pennsylvania locomotive equipped with the Wal-

schaert valve gear was received from the Baldwin Locomotive Works during the latter part of June, 1905, and has been in actual service since the first of July, hauling heavy freight trains over the Middle Division, from Harrisburg to Altoona. This engine, No. 2751, is of the Pennsylvania standard freight class H-6-B, and during its five months of service has covered 22,000 miles without a failure due to any part of its valve gear. It met with an accident, however, and is now in the Harrisburg round-house receiving a new set of side sheets, stay bolts and flues. A careless hostler fired her up, after a check valve had been reground, and neglected to find out if there was any water in the boiler.

A careful examination of the pins and bearings of the valve motion on this engine fails to disclose any decided wear or defect, and with the exception of the brasses on the eccentric rod end the work is just as it was received from the builders. The valves have been reset once in five months, and this setting was only necessary because the balance rod had worked loose and thrown the valve out to some extent. At this point it may be well to mention that this engine is the only one equipped with the stub end eccentric rod and split brasses. All that have since been received have the solid end with the customary brass bushing.

Five months of good service is scarcely enough upon which to base a claim of success, but a systematic inquiry among round-house machinists and engineers will soon disclose the future of any new departure. With 107 of the Walschaert gears in use on locomotives running between Harrisburg and Altoona, it was not hard to obtain a wide range of criticism. The general opinion, however, is expressed in the words of one old engineer who was so fond of his new engine that he said: "I hate to leave her at the round-house and go home to sleep. I'm afraid some one will steal her." The engines are not thrown into a "pool" on this division, as is often the custom, but one engineer is assigned to a locomotive, and is responsible for any failures that may occur. All of the 107 have shown good steaming qualities, and have pulled their trains as well as their sister engines, with the ordinary Stephenson link motion. Failures that have been reported were due to the exhaust nozzles, which were originally 5½ in. in diameter, and are now being bushed down to 5¼ in.

Much criticism having been heard with regard to the number of pins necessary in the Walschaert motion and the valve troubles caused by their wear and subsesquent lost motion, special inquiries were made, and it was discovered that while some of the pins did give trouble occasionally, it was more the result of heating than any lost motion. The pin that holds the link hanger to the end of the reverse shaft arm is one of the most frequent offenders; and the valve stem pin is also the cause of considerable trouble, due to faulty design in the oil cellar. The oil is compelled to travel three or four inches from the cup before it lubricates the pin, and in this distance the hole becomes clogged with dirt. It is necessary to exercise great care in the design and workmanship on this gear because with 12 pins and their bearings on each side of the locomotive something will sooner or later be likely to give trouble.

On the Southern Pacific Railroad a similar form of "grasshopper" valve gear, known as the Stevens, was placed in use many years ago and a number of the engines are still running on the divisions between Sacramento and Portland, but the experiment was not deemed successful, owing to the great wear on the pins, and other reasons best known to the superintendent of motive power of the road. This gear differs from the Walschaert in the construction of the valve and valve stem, there being a double valve with one stem working through the other which is hollow.

From the machinists in the Pennsylvania round-house there was a diversity of opinion, but the only general complaint was with regard to the work necessitated in reducing lost motion between the crosshead and guide bars, the latter being of the "wing" type. Under ordinary circumstances it is sufficient to line down the top guide bar to take up light wear, but in this case it is impossible to do so because the mechanism that supports the valve rod attachments is bolted to the upper guide bar and it would not do to move it from its original position. It is therefore necessary to disconnect the crosshead from both piston and main rod, and place liners under the crosshead shoe or else resort to loose liners. This is a heavy job for round-house men and some dissatisfaction may be expected when it is considered that they are working on the piece work system.

Added to the opinion expressed by both engineers and machinists, the general road foreman of engines dispelled all thoughts of non-success that might have lingered in the mind of a conservative inquirer. He was loud in his praises of the "grasshopper" motion, and remarked that the engines on his division were never doing better work with fewer failures than at the present time. He insisted that the machinists at either end of the division were disappointed because there was really so little work to be done when a run was complete.

The first engine equipped, and one already mentioned, No. 2751, has given the best service of any so far in use. This is accounted for from the fact that special pains were taken in its construction, as it was known to be a test locomotive. The others, however, are doing their share of the work and averaging about 4,400 miles a month. Two were repaired, owing to a wreck, shortly after they were received, but in no case have they fallen down through defective valve motion.

The argument has been raised at times that with this motion a small amount of lost motion at the driving box of the main drivers would amount to considerable when transmitted to the eccentric rod at the end of the crank pin. The work of these engines fails to reveal any fears from such a cause as that. It is a much better proposition for the engineer to have important parts outside where he can inspect them easier, when oiling up, and give them the attention that is practically impossible when leaning over the tops of driving wheels, or crawling underneath.

From the above discussion it is evident that with engineer and machinist satisfied, and the road foreman anxious to get more engines of the same type, but one conclusion can be reached, which is that the Walschaert valve motion has come to stay. The present design will no doubt be improved with great rapidity, especially the sliding cross-head that guides the valve rod. There is already a visible difference between No. 2751 and those that have come from the shop during the past month. As yet the engines equipped have only been used for freight service, but with such satisfactory results it is only a question of time when they will enter the passenger field.

Other roads will follow in the footsteps of the Pennsylvania, and although the progressive Rock Island has been building them for some time, and is at present receiving quite a few, we must credit the Pennsylvania with taking the lead in a step that marks an important milestone in American motive power development.

THOMAS F. CRAWFORD.

An English Visitor.*

30 Streatham High Road, London, S.W., Jan. 2, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

About a year ago I was traveling from New York to Chicago. I was in the smoking car, and sitting next to me was a genial American, who, guessing that I was an Englishman, pleasantly opened a conversation with me. After chatting about various subjects we came to talk of the comfort and convenience of modern travel, and as we were then in one of the most luxurious of modern trains I remarked upon the excellence of its appointments. My friend agreed with my observations, but said he could not understand why there were so many more fatalities on the American railroads than on those of England. "Oh, it's because their trains go so slow," replied a railroad official who was standing near to us. I was rather surprised to hear this, and told him that he was certainly mistaken. It was evident, however, that he persisted in his belief. I spent several months in the United States, traveling many thousands of miles, and so prevalent did I find this error that I determined to do what I could to correct it. My first intention was to make a list of all the regular daily trains in England which attain or exceed an average speed of 50 miles per hour. These, however, I found were so numerous that I was constrained to limit my list to trains which, besides fulfilling these conditions run for distances of not less than 100 miles. Even that I found would occupy much more time than I could devote to the subject, so I have contented myself with giving a list which, although very incomplete, will, I think, be sufficient to show that English trains do not "go so slow."

I would like to add a few further remarks concerning railroads in general and English railroads in particular. Most people will agree that it is far more desirable to have a frequent service of trains running between important points at rates averaging between 40 and 50 miles per hour than to have a relatively meagre service of slower trains, relieved by three or four, which attain much higher speeds. And in this respect surely the English railroad companies serve the public exceedingly well. As an illustration of this I give in my table 35 more or less important British towns and cities, distant 100 miles or more from London, and indicate the number of trains which run between them and the Capital daily (except Sundays). The speed of most of these averages more than 40 miles per hour, and several, as will be seen, attain or exceed 50 miles per hour.

Many of the cities named are connected with London by one or more railways which I have not mentioned because the route

*Our correspondent offers a defense where he is not accused, at least not by well-read Americans: for his main point, that English railroads run large numbers of trains at very high speed, is well understood. Nevertheless we print his letter because he presents a fresh study of the time-tables and because he sets forth the facts in a form somewhat different from that with which the American reader is familiar. It will be observed that the fastest train in the list is one of the Great Central, between London and Leicester, 103 miles, at 59.4 miles an hour. The Great Western runs three trains to Bristol at substantially the same speed (59.2), and these, we believe, make the stop at Bath. Other specially fine runs are those of the Great Central to Sheffield, 164¾ miles, at 58.1 miles per hour; the Great Western to Exeter, 193½ miles, at 56.7, and the London & North-Western, to Liverpool, 201 miles, at 56.1.—EDITOR.

is longer and takes little through traffic. Berwick, for instance, is reached by the Midland Railway.

As I wished to show the number of fast trains available for each of the places mentioned I have been obliged sometimes to give the same train more than once. Some of the trains going to Bath, for instance, go to Bristol and Exeter also. But of the 259 given in Column V. 155 are absolutely distinct and separate trains. Some English expresses lose a good deal in speed by the caution which they have to exercise while in the neighborhood of London or other large cities where there is much local traffic. For example, the Great Central Railway's Sheffield express, which leaves London at 3.25 p.m., when once clear of the Metropolitan lines at Quainton Road averages 60 miles an hour for the remaining 120 miles.

When one considers the rapidity with which trains follow one another on the English railroads, the high speeds at which they run, their punctuality and the extremely small number of fatalities which occur, it must be admitted that they are managed very efficiently. As regards the comfort of traveling on the English lines, one could hardly wish for more luxury for a five or eight hour journey than is provided in the splendid "Cornish Riviera Express" of the Great Western Railway, the equally fine Scotch Expresses of the Midland, the Great Northern, and the London & North Western, the "Grampian Corridor Express" of the Caledonian, or, indeed, of any of the main line trains of the principal companies. And for a journey of an hour or two, Englishmen, at any rate, find the compartment carriages very comfortable. When criticising railroads it is essential to take into account the conditions under which they are run, and the requirements of the public whom they serve, considerations too often neglected by those who make comparisons between the railroads of England and America.

FRANK FAIRER SMITH.

Fast Regular Trains in England and Scotland.[1]

I. Name of place.	II. Railway.	III. Miles from London.	IV. No. of daily regular trains.	V. No. of trains av'g 50 m.p.h., or higher.	VI. Speed of fastest train.
Bath	G. W.	106⅞	43	9	59.3[2]
	L. & S.-W.	148	14	..	....
Berwick	G. N.	339	16	1	50.1
Birmingham	G. W.	129¼	21	5	55.4[3]
	L. & N. W.	113	30	8	56.5[4]
Bournemouth	L. & S.-W.	108	24	1	51.4
Bradford	G. N.	190¼	20	1	50.5
	L. & N.-W.	219	22	..	....
	Mid.	208	29	..	....
	G. C.	203½	16	..	....
Bristol	G. W.	118⅜	33	10	59.2[5]
Carlisle	Mid	310½	22	1	50.3
	L. & N.-W.	299¼	25	..	....
Chester	L. & N.-W.	179	28	2	50.4
	G. W.	214	14	..	....
Crewe	L. & N.-W.	158	47	16	54.5
	G. W.	173	10	..	....
Darlington	G. N.	232	24	1	52.0
	Mid.	246	22	..	....
Doncaster	G. N.	156¼	38	7	55.5
	G. E.	180½	11	..	....
Durham	G. N.	256	15	1	52.0
	Mid.	400	18	..	....
Edinburgh	G. N.	395	22	3	50.9
	L. & N.-W.	..	14	1	50.0
	Mid.	404	13	..	....
	G. C.	..	10	..	....
Exeter	G. W.	193½	24	9	56.7[6]
	L. & S.-W.	171½	17	4	52.8
Glasgow	L. & N.-W.	401½	14	1	....
	G. N.	444	14	..	....
	Mid.	..	14	..	....
	G. C.	..	9	..	....
Grantham	G. N.	105¼	51	18	54.0
Harrogate	G. N.	203	27	3	....
	G. C.	218	10	..	....
	Mid.	..	24	..	....
Holyhead	L. & N.-W.	263½	18	1	50.2
	G. W.	298	11	..	....
Leamington.[7]	G. W.	106	23	6	57.8
	L. & N.-W.	97½	28	3	53.2
Leeds	G. N.	186¼	26	4	52.3
	Mid.	196¼	37	9	....
	L. & N.-W.	220½	22	..	....
	G. C.	201	12	..	....
Leicester.[8]	Mid.	99¼	48	20	56.7[9]
	G. C.	103	27	7	59.4[10]
	L. & N.-W.	115½	20	..	....
	G. N.	..	6	..	....
Liverpool	L. & N.-W.	201	24	7	56.1
	Mid.	218½	23	2	50.4
	G. W.	230	14	..	....
	G. C.	240½	19	..	....
	G. N.	..	17	..	....
Manchester	Mid.	185	27	5	52.6
	L. & N.-W.	183½	28	5	52.4
	G. C.	206	20	3	53.7
	G. N.	203½	17	1	50.9
	G. W.	219	11	..	....
Newark	G. N.	120	30	3	50.3
Newcastle	G. N.	272	28	6	52.6
	Mid.	297½	22	..	....
Newport (Mon.)	G. W.	133½	24	4	52.3
Nottingham	Mid.	125	36	11	56.8[11]
	G. C.	125½	26	5	57.5
	G. N.	128	29	2	54.8
	L. & N.-W.	..	10	..	....
Plymouth	G. W.	246	21	5	55.7
	L. & S.-W.	230¾	12	..	....
Sheffield	G. C.	164¾	22	4	58.1
	G. N.	162	20	4	57.2
	Mid.	158½	35	3	52.8
Shrewsbury	L. & N.-W.	162¼	19	1	50.6
	G. W.	171½	15	..	....
Stafford	L. & N.-W.	133½	38	12	56.4
Stockport	L. & N.-W.	177½	31	7	53.8
	Mid.	..	18	..	....
Wakefield	G. N.	175¾	26	5	55.8
	Mid.	184	25	..	....
Worcester	G. W.	120½	21	4	55.6
	Mid.	156	18	..	....
York	G. N.	188¼	34	8	52.7
	G. E.	212½	7	..	....
	Mid.	..	24	..	....
	G. C.	..	16	..	....

[1] G. W.—Great Western; L. & S.-W.—London & South-Western; G. N.—Great Northern; Mid.—Midland; L. & N.-W.—London & North-Western; G. C.—Great Central; G. E.—Great Eastern.
[2] Bath: two of the 9 trains at 55.7, and two at 54.5.
[3] Birmingham, G. W.: four of the five faster than 54 miles per hour.
[4] Birmingham, L. & N.-W.: seven of the eight at 56.5.
[5] Bristol: three of the 10 over 55.
[6] Exeter: four of the nine over 55.
[7] Leamington, G. W.: four of the six over 55.
[8] Leamington on the L. & N.-W., and Leicester on the Midland are both just under 100 miles from London, but as they are over 100 miles distant by the other lines which serve them, they are included.
[9] Leicester, Midland: seven of the 20 over 55.
[10] Leicester, G. C.: four of the seven over 55.
[11] Nottingham, Midland: four of the 11 over 55.

Scranton Tunnel of the Lackawanna & Wyoming Valley.

The Lackawanna & Wyoming Valley Railroad, or the Laurel Line, as it is generally known locally, is a standard-gage, double-track, rock-ballasted, third-rail electric road, controlled by the Westinghouse interests. It is laid with 90-lb. rail on private right-of-way throughout its length from Scranton to Wilkesbarre, Pa. The line was put in operation between these points in December, 1903. A full description of the road from an engineering standpoint was published in the *Railroad Gazette* of April 22, 1904, when also its traffic possibilities were discussed editorially. The road then entered the city of Scranton by a temporary location known as the Erie cut-off, with steep grades (4 per cent.) over a hill that was to be pierced by a tunnel.

This tunnel was, on October 19 last, opened for service. It connects with the line first built at a point about half a mile from the Scranton passenger terminal at its north end, and at a point over the hill beyond South Scranton at the south end. It has saved a considerable amount of distance, and, more important still, has reduced the ruling grade on this section from 4 per cent. to 1 per cent. The grade through the tunnel is 1 per cent. and 0.8 of one per cent. The accompanying photographs show in order passing through the tunnel from north to south the portals and typical sections in the tunnel.

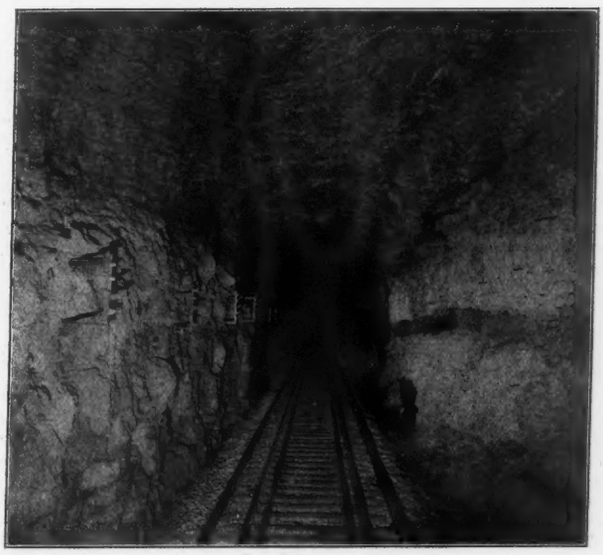
Work was begun on July 5, 1904, and was carried on from both ends and in both directions from two shafts, making six working headings. The first round of shots was fired at the north end on August 12, 1904, and at the south end on September 8 of the same year. The headings met between the two shafts on June 10, 1905, giving a continuous opening from portal to portal. The excavation was completed on July 19, 1905.

The tunnel is 4,747 ft. long. Of this distance 1,300 ft. is solid rock section, 750 ft. masonry lined, and 2,700 ft. timber lined. The masonry-lined section is 17 ft. wide by 22 ft. high, and the timber-lined section is 18 ft. wide by 23 ft. high. These dimensions give plenty of clearance to the largest type of Pullman car or freight car. The two tunnel shafts are each 10 ft. by 20 ft. No. 1, the southerly shaft, is 110 ft. deep, and No. 2, the northerly shaft, 180 ft. deep. The excavation for the shafts amounted to 2,700 cu. yds. The tunnel excavation was 88,000 cu. yds., of which 16,000 cu. yds. were taken out at the south end, 30,000 cu. yds. out of the south shaft, 20,000 cu. yds. out of the north shaft, and 22,000 cu. yds. were taken out at the north end. At the top of one of the shafts the company bought more than a city block of swamp land, where the excavated material was wasted and the lots made available for building purposes. The tunnel contains 3,500 cu. yds. of concrete lining and 1,150,000 ft., board measure, of timber lining in place. The excavation for the approaches amounted to 45,000 cu. yds., and there were 3,000 cu. yds. of concrete used in the approaches. The gauntlet track through the tunnel is operated by the Union Switch & Signal Company's electric train staff system, the installation providing for a possible consecutive movement of 20 trains in one direction. The photographs show in remarkable detail the characteristics of the rock, masonry and timber sections of the tunnel, and also the concrete portals at both ends of the tunnel.

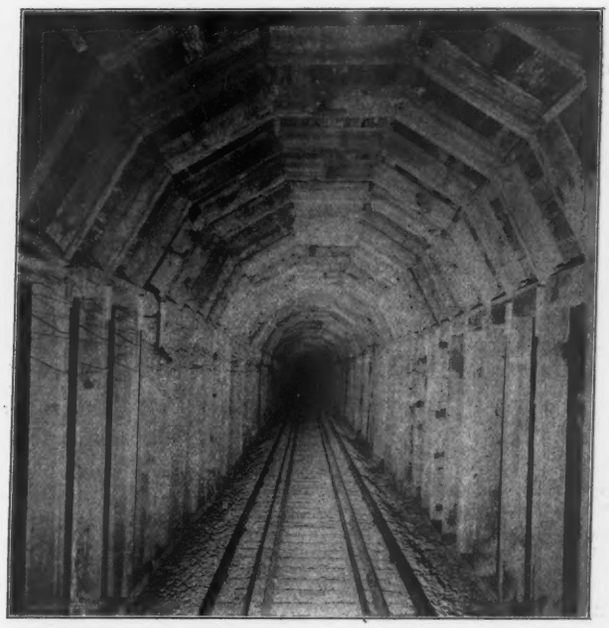
The regular passenger schedule provides for 20 southbound and 17 northbound trains through the tunnel out of a total of 81 trains daily in each direction. There are 13 limited trains a day in each direction which make the 20-mile run between Scranton and Wilkesbarre in 30 minutes, including two stops and three minutes spent in running over the last mile into Wilkesbarre. These all use the tunnel. The company is building up a freight service both in package freight and in carload lots. Trains of two or three freight cars are hauled by 300-h.p. freight motors. The elimination by the tunnel line of the 4 per cent. grade of course greatly increases the load which a motor can handle. The maximum grade on the

North Portal.

In From North Portal—Masonry and Concrete Section.



Rock Section.



Timber Section.

In From South Portal—Concrete Section.

South Portal.

Scranton Tunnel of the Lackawanna & Wyoming Valley.

whole line is 2 per cent. near Pittston, which is about half-way between Scranton and Wilkesbarre.

The Scranton tunnel was built by the Lackawanna Tunnel Company, Westinghouse, Church, Kerr & Co. being the engineers for the railroad company, and Mr. P. B. Easterbrooks the Assistant Engineer in Charge. The Rinehart & Dennis Co. were the contractors. For the photographs and other information we are indebted to Mr. Charles F. Conn, Vice-President of the Lackawanna & Wyoming Valley Railroad.

Electrolysis and Water Pipes in New York City.

The precautionary measures taken by the New York City Department of Water Supply in Manhattan and Bronx boroughs to prevent the destruction of pipes by electrolytic action resulting from stray return currents from the electric roads are interesting. They have been costly, but reasonably successful. Below 125th street all of the surface roads are operated with the conduit system, using the track rails as a return circuit as in the overhead trolley system. When the conduits were first put in the entire track structure was designed to be as substantial and permanent as possible. Extra heavy sections of rails were used and the joints were either cast or electrically welded, in addition to which copper bonds were applied at certain points. The Department of Water Supply insisted on the most effective means being taken to prevent leakage to the ground and adjacent parallel mains, and the street railway company in compliance with these demands designed the conduit structure with ducts in the walls of the underground chambers in which return copper cables were laid connected to the track rails every 500 ft. and extending from the end of each section of the road back to the ground connection at the power stations. At the same time, wherever it was necessary to do so, the water mains were removed from under the tracks and relocated at a minimum distance of 5 ft. to one side of the nearest track rail. These measures proved effective from the beginning in nearly every case. In some places where crossings of car tracks over-lie a network of water mains stray currents have done some damage to hydrant and service connections 40 or 50 ft. away from the crossing, requiring the renewal of the connections at infrequent intervals, although not causing the complete destruction of the pipes. Readings taken at these places with a voltmeter at the time the excavations were made showed a perceptible flow of current at varying potentials, proving the damage to have been caused by electrolytic action.

On the upper end of the Island and in the Bronx, where there are a number of surface roads using the single overhead trolley, the cases of damage and even total destruction of pipes underground have been more numerous. The track rails, often poorly bonded at the joints, are relied on to carry the return circuit without the use of a supplementary copper return cable. Wherever the tracks run parallel to the water mains the Department of Water Supply has required the company to pay the cost of the relocation of the pipes to one side of the tracks, but this has not entirely prevented electrolytic action. At crossings and other points of excessive leakage copper cables have been laid in the ground around the path which the current seeks to follow in the pipes, and these are bonded to the rails at each end to form a continuous metallic circuit. This is a makeshift expedient and not to be compared in efficiency with the parallel copper circuit used with the conduit system. Service and hydrant connections are the principal points of attack by stray currents, and these are renewed in some places at quite frequent intervals. The chief damage is done at the wiped joints in the lead service pipes, which are eaten away or so badly oxidized that they crumble when exposed. The railroad companies when called upon to settle claims for the cost of renewing damaged service connections usually pay up without protest. Near the power stations the usual copper returns are laid throughout the danger zone and are fairly effective.

When the Elevated Railroads were changed from steam to electricity the entire structure was carefully bonded with copper at every point in the longitudinal girders, and the track rails were likewise bonded. While some evidences of electrolysis are found at junction points and crossings where the path of the return current is not continuous, underground structures have not been affected to any appreciable extent.

The Subway has not been in operation long enough to determine whether or not stray currents from the rails are causing damage to the water pipes laid along side or above the tunnel. At places where the Subway lies under a network of pipes the voltmeter shows a flow of current up the columns and thence to the pipes. At other points no flow of current can be detected. It has been suggested that in case damage is found to result from these stray currents one or more of the ducts already provided for in the walls of the tunnel could be used for carrying a return copper cable connected to the track rails every 1,500 ft., as is done with the surface conduit roads. The Subway structure differs from the elevated roads in the distribution of the steel work. On the Elevated the girders are longitudinal and form a good metallic return independent of the track rails. In the Subway the cross girders in the roof are supported on separate columns without longitudinal girders except at a few stations and cross-overs, and there is thus no continuous metallic system. Any leakage of current finds its way up the columns to the pipe systems overhead.

Signal Arrangements for the New York Central Electrified Zone.*

The block system to be installed within the Electrification Zone territory of the New York Central in the vicinity of New York is to be arranged with an overlap of the full length of the block. An engineman will then be given two warnings and two chances to stop before it will be possible for a train to overtake another on the same track.

The signaling will be the most complete, and, it is felt, the most perfect of any installation that has ever been made. It certainly will be the largest and most expensive, and the cost would be considered prohibitive if the signals were not necessary for the safe operation of trains. No expense is to be spared to provide every feature that will add to the safety of operation, as where safety is concerned it will not do to be "penny wise and pound foolish."

The block system to be installed is the automatic electric. An alternating current will be required for the track circuit, and a relay that is acted on only by an alternating current and not by direct current will have to be used. Alternating current is principally employed in street and house lighting, and, owing to the ease with which the voltage may be raised or lowered by means of a transformer, its field of usefulness is very large. An alternating current, as will be understood from its name, is one where the current is alternately made to flow in one and then in the opposite direction. The frequency of the alternations or number of current impulses occurring in a given time are termed cycles; and these ordinarily vary from 25 for power currents to 60 and even 133 cycles for lighting circuits. The alternating current to be used in the track to operate the track relay will be of 25 cycles, and distributed on two main wires strung on the transmission line poles, some of which may be seen now in place at Spuyten Duyvil. Owing to the large current required and the long distance it will have to be transmitted from the power stations, the current in the main signal lines will be of 3,000 volts potential; and at each location where signals are to be placed a transformer will be connected to the line to step the current down from 3,000 volts to 50 volts.

A current of 50 volts potential is a convenient one to use for the various circuits forming part of the signal system. It is to be employed to light the lamps in the signals, work the signal motors, the switch indicators, the relays and all circuits of the system except that of track where, owing to the low insulation between the rails, a low voltage current must be used. For the track circuits the voltage is to be reduced by a second transformer from 50 to 6 or even 2 volts, according to the length of the track circuit section. An alternating current, owing to the change from zero to full voltage, sets up an opposing magnetic resistance in the rails; and, as the resistance varies according to the length of rail through which the current passes, the voltage used must be proportioned to the length of the track circuit.

The relay required differs materially from the ordinary form of relay used for track circuit purposes. A relay of the ordinary type is acted on by any small direct current; and as there will be large quantities of direct current flowing through the track and wires that are connected to the same, a relay that is worked by the alternating current only is a necessity. The alternating current relay is, in fact, nothing more than a motor, the armature of which is allowed to turn about ¼ of a circle in place of making a complete revolution. There are two forms of these relays in use; one, a single-phase relay taking its current only from the track, and requiring a comparatively large current, as sufficient has to be received at the relay to magnetize the fields and turn the armature. The other type is really a two-phase induction motor with two field windings. One of the windings takes current from the 50-volt power line, the other the low voltage from the track. The ample power of the 50-volt current is used to furnish the major portion of the energy required to actuate the relay, and only a small current is required from the track to give the necessary rotation of the armature. The current in the two windings must differ in phase or time of maximum intensity by about 90 degrees, or one-quarter of a cycle period, in order to produce the necessary pull, and the direction of rotation depends on the relative phase of the two currents. If the relation of the phase of the currents is reversed, the armature will turn in the opposite direction to the normal and thereby cause the signal to indicate stop. Protection is thus secured against a breaking down of the rail-insulating joint, as the current coming through from the transformer of the adjoining track section

*Extracts from a paper by W. H. Elliott, Signal Engineer of the New York Central, in *Railroad Men* for January.

will be of a different phase and rotate the armature in the direction to cause a separation of the contact points opening the signal circuit and causing the signal to indicate stop.

A most important part of the track circuit equipment is the reactance bond. This bond is designed to allow the direct current returning to the power house to pass from one section of the track to the other, while it must stop the alternating current from passing to the next sections in sufficient quantity to interfere with the working of the relay of those sections. Accurate calculations have had to be made and much ingenuity displayed in the design of these bonds, for they must be so proportioned as to pass 3,000 amperes of direct current continuously while stopping the alternating current and limiting it to the track section where it is to be used. These bonds are formed of a copper bar 1 in. square and about 30 ft. long, bent in the form of a coil and placed in an iron box and surrounded by oil to carry away the heat generated by the current passing through the bond. A bond is required for each end of a track circuit. There are about 1,000 track circuits in the electrification zone, and as the bonds cost about $150 apiece it will be seen that apparatus of this kind is quite expensive. Each bond allows approximately 60 watts of current to pass, in order to render the bond effective to any larger current; and as about 30 watts of current is lost in the track section, a total of 150 watts is required to operate each track circuit. One hundred and fifty watts is approximately one-fifth of a horse-power, or a total of 200 horse-power is required for the 1,000 sections on the 54 miles of four-track railroad to be signaled. As illustrating the great expense there will be in operating the new system, it should be remembered that for 1,000 track circuits worked by direct current obtained from gravity batteries but 1¼ horse-power would be required.

In operation the new system should be an ideal one, for there will be no batteries of any kind to need cleaning and inspecting and no lamps will have to be lighted. All power will be supplied from the sub-stations, and unless some of the connections break or are burnt out by lighting there is little to go wrong. The alternating current relays and magnets are quick in releasing, and there is small danger of the signal being improperly held in the clear position from residual magnetism, as sometimes happens with the battery-operated systems. Ample power is available to work the signals quickly, while they may be loaded heavily enough to overcome a lot of ice on the blade or increased friction in the parts which might keep the signal from changing to the stop position.

In almost every way the system is an ideal one, and while it will be expensive in first cost and the cost of operation will be high, the increased efficiency and greater safety in working will more than compensate for the large outlay of money.

The interlockings to be installed will be of the latest type of power apparatus, and the safeguards which practice has shown to be necessary will be provided. Electric locking of the switch levers will be used to prevent the switch being thrown under a train, as with the modern rail and a power-operated movement it is difficult to so locate the detector bar that it will be stopped by the wheel and prevent the movement from opening the switch when there is a train over the points.

In the Grand Central yard, where, in time, all of the tracks will be covered by buildings or streets, the tower floor on which the interlocking machine will be placed will be almost level with the car floor, and a car standing or passing in front of the tower will completely shut off the view. As the largest interlocking machine will have 172 working levers controlling about the same number of switches and signals as the machine now in use, it will be realized that the conditions under which the signalman will have to work will be extremely difficult. It is expected that the operation of the plants will be carried on almost entirely by information furnished by a track indicator which has been designed to show when each section of a track is occupied by a train. The sections will be limited to one or two switches and comparatively short pieces of track. Each section will be provided with a track circuit, and in the Grand Central terminal there will be 426. These track sections will control a relay in the tower which will close a circuit to a lamp giving a white light when the track is not occupied and another lamp giving a red light when a train is on the section. A red and a white lamp will be provided for each section, and the sections will be represented on a large piece of ground glass placed in a frame and hung on the wall of the tower in front of the signalman. Small partitions on the back of the glass will keep the light from one section showing through to that of the next, and those sections which are showing red will be understood as being occupied by a train.

The large number of high-speed trains which are now being run to meet the demands of the public has made it necessary to convey to the engineman by means of a signal certain information which it has not heretofore been attempted to give. The introduction of the long cross-overs through which trains may run at speeds of from 40 to 50 miles an hour has made necessary the use of an additional signal arm to indicate when the route is set for a train to take such cross-over. Instead of limiting the number of arms on any pole to two for almost all situations, as has been the practice for a number of years, three arms now have to be used, of which the top arm will govern movements to be made to the unlimited route, the second arm will govern movements over the limited speed route, and the lower arm govern movements to be made to all other routes. Such use of the signal is what is termed speed signaling, and for roads that have four or more tracks and long cross-overs such a system is necessary if the benefits to be derived from the use of these cross-overs is to be secured.

The conditions of modern practice require that a distant indication shall be given for each home signal where a movement is made from one main track to another in a direction with the current of traffic. To give this indication requires the use of at least five arms. The upper arm, the home signal for the unlimited speed route; the second, the distant signal for the home signal in advance on the same route; the third, the home signal governing through cross-over to main track running in the same direction; the fourth, the distant signal for the next home signal in advance on this other main track, and the fifth, the home arm governing movements to the other main or side tracks. With a spacing of 6 ft. between each arm and the pole located on a signal bridge, the top arm will be 58 ft. above the track. At such a height it is difficult to see the light when near to the signal, and even in the daytime the position of the arm cannot be told with desirable certainty. When standing under the signal the light may be seen between the spectacles and the lamp, and mistakes have been made in assuming the signal was clear when it was not. It is therefore practically out of the question to put so many signals on a pole placed on a signal bridge.

The situation may be materially improved by the user of the three-position signal, by which means the stop indication, the distant indication for the next signal in advance and the proceed indication may be given by one signal and the number of signals on a mast reduced from five to three. The proceed indication is given by the arm when in a vertical position, the cautionary indication when the arm is in the 45-degree position, and stop is indicated when the arm is horizontal. Such use of the signal requires that the sweep of the arm be 90 degrees instead of the 60 degrees which the signals on the New York Central now move through when being cleared. The giving of the distant or cautionary indication by the arm when in the 45-degree position is a new feature which should aid materially in the safe operation of trains. At the present time the distant signal is distinguished by the arm having a forked end, and when indicating caution it stands in a horizontal position the same as the home signal. As the forked end cannot be distinguished until the engineman is quite near, it is possible and has sometmes happened that a home signal will be mistaken for a distant signal and the mistake not noticed until too late for the train to be stopped at the home signal. With the cautionary indication given by the position of the arm, a mistake of the kind indicated cannot occur, for the character of the indication is denoted by the position of the arm and not by its form. With the 3-position system of signaling, an arm in a horizontal position means stop, no matter where the signal is located, and an arm in the 45-degree position will mean caution, whether or not the end of the blade is squared or notched. The proposed change is a very decided one from the standpoint of present practice, for, according to the rules now in force, an arm in the 45 or greater degree position means proceed.

An arm in the vertical position will stand parallel with the side of the pole and not be as easy to see or as distinctive as when in the 60-degree position. To make the blade more distinguishable and also to have the weight of any ice or snow that may collect on the blade assist in carrying the arm to the stop position, many signal engineers recommend that the arm be made to move upwardly from the horizontal position when giving the proceed indication, instead of downwardly as is the present practice. If adopted, this practice will be a very decided change, although the moving of the arm upwardly to give the cautionary indication is used by the Santa Fé and the Erie. In Germany the signals are made to move upwardly to give the proceed indication, so there is nothing new in the practice.

With the vertically-raised arm the greater part of the blade will be made to extend above the top of the pole, and with a proper offset from same can be easily recognized as a signal arm and not as an extension of the pole. It is true this greater distinction of the upwardly raised arm over the one that is downwardly inclined will not be had for any except the top arm, but the top arm is the most important signal governing trains moving on the unlimited speed track; and a change which will make this signal more distinct is undoubtedly warranted, although the appearance of the other signals on the pole will not be improved. It has been suggested that the change to the upwardly moving arm be made with the signals to be installed within the electrification zone; while it has definitely been decided to change from a white to green light for the proceed night signal indication, yellow being used for the cautionary indication, and red, as now, to indicate stop.

December Railroad Law.

The following abstracts cover the principal decisions on railroad cases handed down during December by the United States Supreme Court and the Federal Courts:

Liability of railroad company for assault on passenger by another passenger.—The Circuit Court of Appeals for the eighth circuit has affirmed a decision favorable to the Rock Island Railroad Company in a case where an unoffending passenger was struck by a missile thrown by an intoxicated person expelled from the train for profanity and disorderly conduct. The missile was intended for the conductor and was thrown without warning. The court, after an exhaustive examination of the authorities, announced as a principle applicable to cases where a passenger is injured by another that the liability of the carrier must depend upon the presence or absence of evidence tending to show that the employees either knew or by the exercise of due care should have known from the circumstances of the particular case, that injury to the passenger was threatened or impending, which injury, by the exercise of that high degree of care which the law requires of a carrier of passengers for the safety and protection of the passenger, might not only have been foreseen but guessed against, thus averting the injury. Brown vs. Chicago, Rock Island & Pacific Railway, 139 Federal Rep. 972.

State taxation of rolling stock used without the state.—The rolling stock of a state corporation permanently located without such state and there employed in the prosecution of its business, is not subject to taxation by the state. The imposition of such a tax is a plain violation of the constitutional prohibition against depriving one of his property without due process of law, and of the well recognized rule of law governing levies for revenue purposes, that tangible property can be taxed only when within the territorial jurisdiction of the taxing power. Union Refrigerator Transit Co. vs. Commonwealth of Kentucky (U. S. Sup.), 26 Supreme Ct. Report 36.

Use of bridges in common.—The Supreme Court has held untenable the ground on which the Union Pacific Railroad Company sought to deny the use of its Omaha bridge to a new railroad recently built into Council Bluffs. The Act of 1871, under which authority for the construction of the bridge was conferred, provided that the Union Pacific Company should be governed and limited by the provisions of an earlier act of Congress authorizing the construction of nine bridges over the Mississippi river at different points. Eight of the bridges were authorized on the express condition that other railroads should be allowed the privilege of crossing for a reasonable compensation. The provision for the ninth bridge (at St. Louis) did not provide for its use by other terminating railroads. The Union Pacific in this case contended that the act of 1871 made applicable to the Omaha bridge only such provisions of the earlier act as were common to all of the bridges mentioned therein, and that the provision for use by other roads was not common to all the bridges. The matter was decided adversely to the Union Pacific by reference to the general policy of the government in authorizing the construction of bridges over navigable streams. Incidentally it was also decided that the purchasers of the Union Pacific Railroad at foreclosure took the property subject to the act providing for a joint use of the bridge, though the mortgage foreclosed was executed prior to the act authorizing the construction of the bridge. Union Pacific Railroad Co. vs. Mason City & Fort Dodge Railroad Co. (U. S. Sup.), 26 Supreme Ct. Report 19.

Land grants to unpatented lands.—Judge Swayne in the Circuit Court for the Northern District of Florida holds that a grant of swamp and overflowed lands to a railroad by the state is not invalid by reason of the fact that a patent to the lands had not been issued to the state by the Secretary of the Interior at the time of the grant. Under this decision the rights of the railroad by virtue of its grant attached at the time of the issuance of the government patent, which right was enforceable against the trustees of the Internal Improvement Fund of Florida by a proceeding for specific performance. Kittel vs. Trustees of Internal Improvement Fund, 139 Federal Report 941.

The Cost of Locomotive Operation.

XX.

BY GEORGE R. HENDERSON.

(*Continued from page 12.*)

UPGRADE WORK CONTINUED.

In the *American Engineer* of April, 1904, Mr. G. J. Bury, General Superintendent of the Canadian Pacific, is quoted as saying: "If freight trains average 15 miles an hour, train and enginemen can make 5,000 miles a month, while if the average be reduced to eight miles an hour, the men cannot stand more than 3,000 miles a month. Sixty crews at 15 miles an hour will make 300,000 train miles per month, while at an average of eight miles an hour it will take 40 more crews, or 200 extra men, to handle that business.

"Looking at the matter from a financial standpoint, a consolidation engine hauls a train weighing 1,100 tons (tare and contents) over 118 miles in a district where there are several grades of 1 per cent.; taking into consideration the time for meeting trains, and letting faster trains pass, slowing up over grades, etc., it averages eight miles an hour, the cost being as below:

Wages, engineman and fireman	$6.90
Overtime for engineman and fireman	1.75
Wages, conductor and brakemen	7.73
Overtime, conductor and brakemen	2.88
Oil and waste for locomotive	.30
Fuel (7 tons at $3.20)	22.40
Total	$41.96

or 32.3 cents per 1,000 ton-miles.

"The same train, if loaded with 1,000 tons, averages 15 miles an hour over the same district, and the cost is as follows:

Wages, engineman and fireman	$6.90
Wages, conductor and brakemen	7.73
Oil and waste for locomotive	.30
Fuel (6 tons at $3.20)	19.20
Total	$34.13

or 28.8 cents per 1,000 ton-miles.

"In a general way locomotives should be so loaded when traffic is dense that they will make an average speed of 15 miles an hour, providing there are no unusual delays."

As indicated by table A (see *Railroad Gazette*, Jan. 5, page 11) if we run above 15 miles per hour, we also reduce our earning capacity and increase our cost per ton-mile. In order to observe the effect of higher priced coal, we have calculated the cost at $2 per ton, the other figures remaining as before. We now obtain as follows:

Table B.

Running speed	5	10	15	20	25	30
Cost per 1,000 ton-miles	0.96	1.06	1.02	1.11	1.32	1.56

Here the speed of five miles an hour shows the lowest cost; but 15 miles gives the next highest rate, and when we consider that the movement and consequently the earning power of the engine per month is nearly doubled, there is little doubt as to the 15-mile policy even under these new conditions.

Tables A and B give the cost per 1,000 ton-miles and the number of million ton-miles per engine per month on a 1 per cent. grade 150 miles in length, when the maximum possible loads are taken at the speeds selected. But if these loads can be hauled we can obviously take lighter ones at these speeds, and we should know how this will affect the cost and quantity of transportation. Let us determine which values composing the cost will be modified by reducing the train load. It is evident that the quantity of coal and water used will be less, and also that the repair account will be diminished, so that items 10, 11 and 14 will be reduced. As less cars will be in the train, item 21—car repairs—will also diminish. Items 12, 13, 15, 16, 17, 18, 20 and 22 will remain constant for each speed, regardless of the train load, in accordance with our assumption, as they are based upon engine miles, trips or hours required for the run. Table C shows how the values are computed for five miles an hour.

Line 3 evidently follows from 2 and the distance—150 miles—being the product as before. Line 7 is found by Figs. 2 and 8, as before, but it was necessary to draw upon Fig. 8 additional lines representing the resistance of trains under 1,000 tons weight, and line 8 simply multiplied these figures by 150. The water (line 9) allowed three-quarters of a gallon for each pound of coal, as previously. Line 10 was based on line 8 at $1 per ton, and line 11 on line 9 at 10 cents per 1,000 gallons. Lines 12 and 13 are the same as previously shown in Table A. Line 14 was based on tractive forces of 19, 17, 14.5, 12, 9.5 and 7 tons respectively.

As determined from Fig. 8 and the additional lines for loads less than 1,000 tons.

Table C.

Reduced Loads.]						[5 Miles per Hour.
2. Weight of train.*	1,400	1,200	1,000	800	600	400
3. Ton-miles per trip,*	210,000	180,000	150,000	120,000	90,000	60,000
7. Coal burned per mile, lbs.	450	340	270	210	170	120
8. Coal burned per trip, lbs.	67,500	51,000	40,500	31,500	25,500	18,000
9. Water used per trip, galls.	50.700	38.300	50.400	23,600	19,100	13.500
10. Cost of coal, per trip	$33.75	$25.50	$20.25	$15.75	$12.75	$9.00
11. " water, per trip	5.07	3.83	3.04	2.36	1.91	1.35
12. " lubrication pr trip	.50	.50	.50	.50	.50	.50
13. " supplies, per trip.	.20	.20	.20	.20	.20	.20
14. " repairs, per trip	30.00	27.00	23.28	19.50	15.75	12.00
15. Allow. renewals, per trip.	1.50	1.50	1.50	1.50	1.50	1.50
16. Pay of enginemen per trip	25.20	25.20	25.20	25.20	25.20	25.20
17. Cost of handling, "	2.00	2.00	2.00	2.00	2.00	2.00
18. Int. allowance, "	4.10	4.10	4.10	4.10	4.10	4.10
20. Cost of train sup. "	2.25	2.25	2.25	2.25	2.25	2.25
21. Cost, car repairs "	31.50	27.00	22.50	18.00	13.50	9.00
22. Pay of trainmen, "	28.98	28.98	28.98	28.98	28.98	28.98
23. Cost of movement "	165.05	148.06	133.80	120.34	108.64	96.08
24. Cost, 1,000 ton-miles, net	.79	.82	.89	1.00	1.21	1.60
25. Million ton-miles per engine month	3.69	3.16	2.63	2.11	1.58	1.05

*Tons back of tender.

Lines 15, 16, 17, 18 and 20 are simply reproduced from table A. Line 21 was figured at 15 cents per 1,000 ton-miles; thus, $210 \times .15 = 31.50$, and line 22 was taken directly from table A.

As before, line 23 is the sum of lines 10 to 22 (as in table C), and the costs in line 24 are the quotients of 24 and 3, thus $\frac{165.05}{210} = .79$. Line 25 has been computed as in table A, and is proportional to the values in line 3.

This process is repeated for speeds of 10, 15, 20, 25 and 30 miles an hour, and we are then able to produce tab.e D, in which the upper figures indicate the cost in dollars per 1,000 ton-miles, back of tender, and the lower figures the millions of ton-miles hauled per engine per month for the corresponding loads and speeds found upon the left-hand column and the top line.

Table D.

Cost per 1,000 ton-miles in Dollars and Million Ton-Miles per Engine Month.

	Miles per hour.					
	5.	10.	15.	20.	25.	30.
400 tons back of tender....	1.60	1.11	1.05	1.10	1.15	1.25
	1.05	1.87	2.54	3.08	3.54	3.92
600 tons back of tender....	1.21	.90	.85	.91		
	1.58	2.81	3.81	4.63		
800 tons back of tender....	1.00	.78	.79	.86		
	2.11	3.76	5.08	6.18		
1,000 tons back of tender....	.89	.72	.76			
	2.63	4.70	6.35			
1,200 tons back of tender....	.82	.70				
	3.16	5.63				
1,400 tons back of tender....	.79	.75				
	3.69	6.57				

These costs are based on coal at $1 per ton, but any other price would be handled in the same way.

In order to show the effect of speed and weight of train upon cost and haulage capacity graphically Fig. 11 is presented, which,

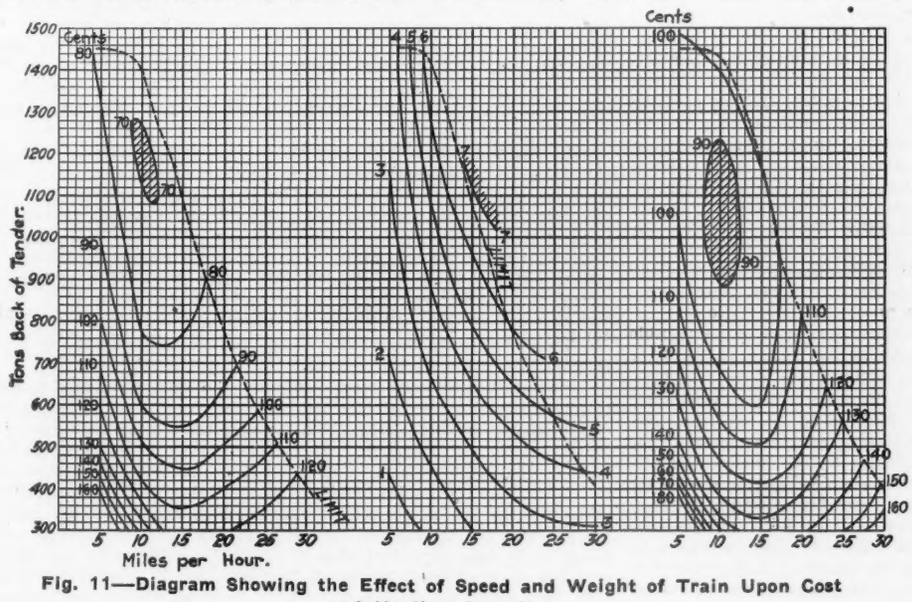


Fig. 11—Diagram Showing the Effect of Speed and Weight of Train Upon Cost and Hauling Capacity.

it is believed, gives the clearest possible illustration of this very important problem. The left-hand diagram gives the cost in cents per 1,000 ton-miles (back of tender), with coal at $1 per ton, and, of course, for the engine and grade selected. The right-hand diagram shows the same when coal is $2 per ton. The center diagram gives the hauling capacity in millions of ton-miles per month for a locomotive. In all these, the speed is shown by the abscissæ (as indicated at the bottom), and the train load by the ordinates, as seen at the left side of sheet. The cost in cents (in the side diagrams) is indicated by the contour lines, that marked 70 corresponding to 70 cents per 1,000 ton-miles, etc. The lowest point or "valley" is cross hatched. Thus if we wish the cost (under the conditions which have been assumed) to haul a train of 800 tons at five miles an hour, we find that the intersection of the five-mile vertical line and the 800-ton horizontal line is crossed by the contour line marked "100" cents, which means that the transportation covered by the accounts mentioned in table A will cost $1 per 1,000 ton-miles, thus agreeing with table D. For a train of 400 tons at 20 miles an hour we find a cost of $1.10 (110 cents), also agreeing with table D. The broken line marked "limit" indicates the maximum speed at which any given load can be hauled. For the conditions covered by the left-hand diagram it is evident that the greatest economy for any definite speed requires that the train be as heavy as the engine can haul "at that speed," except in the portions above the shaded "valley of minimum cost."

We found in table D that the minimum cost was obtained with 1,200 tons at 10 miles an hour, and this point in Fig. 11 is in the center of the "valley." As might be expected, there is little change effected by a variation of 100 tons either way, but a very marked difference is caused by a change in speed of three or four miles per hour. For instance, with 1,200 tons, if the running speed be reduced to six miles an hour, the cost will be 80 cents per 1,000 ton-miles. A higher speed will also increase the cost of transportation.

In table A, which gave maximum loads only, it was seen that 15 miles an hour with 1,100 tons was the most economical combination. However, table D indicated that the greatest economy was not at a maximum or full load, and Fig. 11 explains this. We also notice that the most economical speed for any possible train load lies between 10 and 15 miles an hour, the lighter the train the higher being the point of economical speed. If we pass away from this speed, the cost rises rapidly, either for slower or faster runs.

Again, if for dead freight we haul 1,200 tons at 10 miles an hour, the cost will be 70 cents per 1,000 ton-miles; if, however, the nature of the merchandise calls for a speed of 25 miles an hour, we must cut our rating to 560 tons, and the cost will be about $1.03, which is the lowest possible for that speed, as any further reduction in load would increase the cost. If the speed for this load were only eight miles an hour, the cost would be the same, but at 15 miles an hour it would be about 90 cents.

The value of this diagram is at once apparent, as a superintendent can decide from it what load and speed to adopt, if both are left to his discretion, or if a definite running speed be demanded, the most economical load is at once found. If for special reasons, a reduced load must be given engines (as in order to get them over the road) then the best schedule to make for them is also immediately obtained. Of course, such a diagram must be constructed for the particular locomotives and the physical characteristics of the division, but this can be readily done by following the processes above described.

The right-hand diagram (for coal at $2 a ton) shows similar characteristics, but the lowest cost is now about 90 cents per 1,000 ton-miles; it is still at 10 miles per hour and extends from 900 to 1,200 tons bank of tender. As the train load decreases, the minimum cost requires a speed of 15 miles an hour. The effect of the price of coal is also shown at high speeds; for instance, at $1 per ton, a speed of 20 miles and a load of 500 tons will cost $1, and with $2 coal, $1.20 per 1,000 ton-miles. In general the cost is from 15 to 20 cents greater.

The central diagram shows contours of million ton-miles per month. Without exception, the maximum ton-mileage for any train load is at the highest speed, and at any speed is with the greatest load, as it obviously should be. The especial point of interest is, however, that at which the maximum results can be obtained. This is especially important in times of congested traffic. It is seen that for the conditions which we have been assuming, a load of 1,150 tons and a speed of 14 miles an hour will result in the greatest freight movement that can be brought about. It is probable that ordinarily an engine of the size selected would be given a train load of 1,430 tons. The total monthly movement per engine would be about 6,500,000 ton-miles; if the load and speed were set as above indicated, 7,000,000 ton-miles could be made.

Perhaps the most interesting feature of Fig. 11 is the close correspondence of the points of minimum cost and maximum capacity. In the case of dollar coal, the best arrangement for cost is 1,200 tons at 10 miles an hour; in the center diagram the greatest hauling capacity is found with 1,200 tons at 13 miles an hour. We also see that for the same cost, viz., 70 cents per 1,000 ton-miles, we can move either 5,000,000 ton-miles per month by hauling 1,280 tons at nine miles an hour, or 6,000,000 per month by taking 1,100 tons at 12 miles an hour. In other words, by properly selecting the train load and scheduling the run, we can operate at the minimum cost and very near the maximum engine capacity, considering the total monthly movement. When the full import of

this diagram is understood, we believe that every division superintendent in the country would find it to the advantage of his company to have such a chart prepared, and that by following its suggestions, he could considerably reduce his cost of operation.

(To be continued.)

Signaling of N. Y. C. Electrical Zone.

It seems to be definitely settled, although not yet officially announced, that the contract for the interlocking and block signal work necessary to equip the Grand Central Station yard and the adjacent electrified lines of the New York Central is to be given to the General Railway Signal Company, of Buffalo. The lines which it is expected to put into operation this year aggregate about 14 miles; Grand Central Station to Mott Haven, 5 miles; Mott Haven to Wakefield, on the Harlem division, 7 miles; and Mott Haven to High Bridge, on the Hudson division, something less than two miles. The contract includes the block signals for all these lines, all four track, and the interlocking throughout, though a few of the smaller present interlocking machines may be kept in service temporarily. There are to be 62 interlocking plants, in all. The principal ones outside of the terminal yard are at Mott Haven Junction, at the Wakefield and High Bridge terminals, at the junction with the Port Morris branch at Melrose, at the junction with the New Haven road at Woodlawn, at the drawbridge over the Harlem river, and at the three or four points where there are cross-overs. All-electric interlocking will be used, and the block signaling will be the General Railway Signal Company's system. The track circuits will be worked with alternating currents. Detector bars will not be used, the locking of levers being done by track circuits.

Some details of the signaling plans for these electrified lines are given in an address recently given by Mr. Elliott, Signal Engineer of the New York Central, extracts from which will be found in another column of this issue.

Washington Correspondence.

Washington, Jan. 9.—Senator Elkins, Chairman of the Committee on Interstate Commerce, has not yet introduced his bill in the Senate, and it is not his present intention to do so. He proposes to hold it back to serve as the basis of the final compromise in the Committee. The present outlook is favorable to an agreement of a majority of the Committee on some measure along the general lines of that prepared by Senator Elkins. It is in a way a combination of the proposition to have rates made by the Interstate Commerce Commission, and the proposition of Senator Foraker to have the courts enjoin all charges in excess of what may be found to be reasonable. It can, therefore, be supported by Senator Foraker as well as by the less radical of the advocates of giving the Commission power to make rates.

The first part of the Elkins bill follows very closely the text of the Foraker bill. It proposes to provide for court injunctions against the continuance of excessive charges or discriminatory practices, but there the principle of the Foraker bill is abandoned. The new rate or practice is not to be determined by requiring the court to specifically enjoin any rate above a certain amount or requiring it to specifically indicate what shall be the practice substituted. It is proposed that the road itself shall substitute a rate or practice subject to the approval of the Interstate Commerce Commission. If the rate or practice proposed by the road is not satisfactory to the Commission the Commission is then to prescribe the rate or practice that is to become operative. In addition to the fact that a case might be carried to the supreme court of the United States in the first instance, the bill is so drawn as to permit a judicial review of an order issued by the Commission after the carrier has failed to substitute a satisfactory rate or practice. This, it is believed, will be entirely satisfactory to those who have insisted that all orders of the Commission should be subject to judicial review. The present draft of the Elkins bill, it is claimed by its advocates, ought to be satisfactory to the advocates of Commission-made rates for the reason that every rate made under it must either be satisfactory to the Commission or made by the Commission itself. It is contended, however, that the Commission would very rarely exercise the rate-making power for the reason that the carrier would generally substitute a rate that would be entirely reasonable in the light of the decision of the court condemning the rate complained of.

Three important rate bills have been introduced during the past week. In the House Representative Hepburn has presented his bill, which is almost identical in its important features with the Dolliver bill. One important point of difference is that the Hepburn bill proposes to require the Commission to make rates that will be "fairly remunerative." The purpose of this is to broaden the scope of judicial review and leave no question as to whether the court could consider whether or not the rate made by the Commission was one that would yield reasonable compensation for the service performed. The Hepburn bill will be made the basis of whatever bill is reported from the House Committee on Interstate and Foreign Commerce, and it is expected that it will be reported substantially as introduced.

Bills have been introduced in the Senate by Senator Morgan, of Alabama, and Senator Culberson, of Texas. The Morgan bill is important as showing that one of the leading authorities on constitutional law on the Democratic side is in harmony with Senator Foraker in believing that the rate-making power cannot be exercised by an administrative commission. Mr. Morgan proposes to afford no remedy for any transportation abuse except a suit for damages to be brought either by an individual or by the governor of a State on complaint from an individual that a carrier is charging excessive rates or is discriminating between individuals or places. It provides no method of fixing or enforcing a new rate for the future, the idea of Senator Morgan being that a carrier would not trifle with the courts, but, when an award for damages in excess of a certain rate had been made, would reduce its rate to the level found by the court to be just. The Culberson bill proposes to have rates made by the Commission, such rates to remain in effect for one year. It provides that a reviewing court, in considering whether a rate made by the Commission is confiscatory or is not such as would yield fair compensation, shall not consider the value of the stock of the road involved, but the actual value of the property of the carrier.

J. C. W.

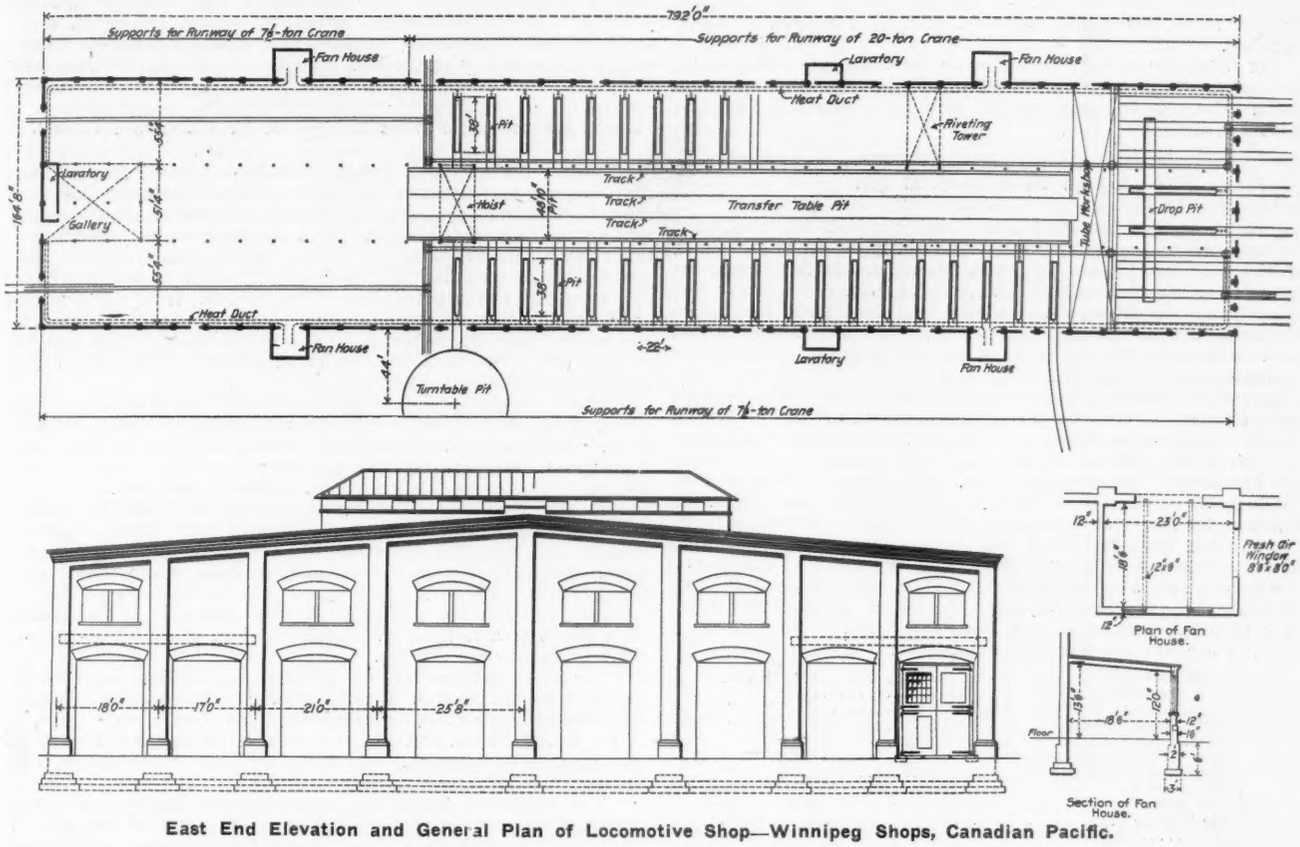
Winnipeg Shops of the Canadian Pacific.

In our issue of Dec. 29, 1905, page 612, was a brief description of the new Winnipeg shops of the Canadian Pacific. Mr. Henry Goldmark, M. Inst. C. E., who was engineer in charge of the construction of these shops, sends the following comments on the design of the locomotive, machine and erecting shop:

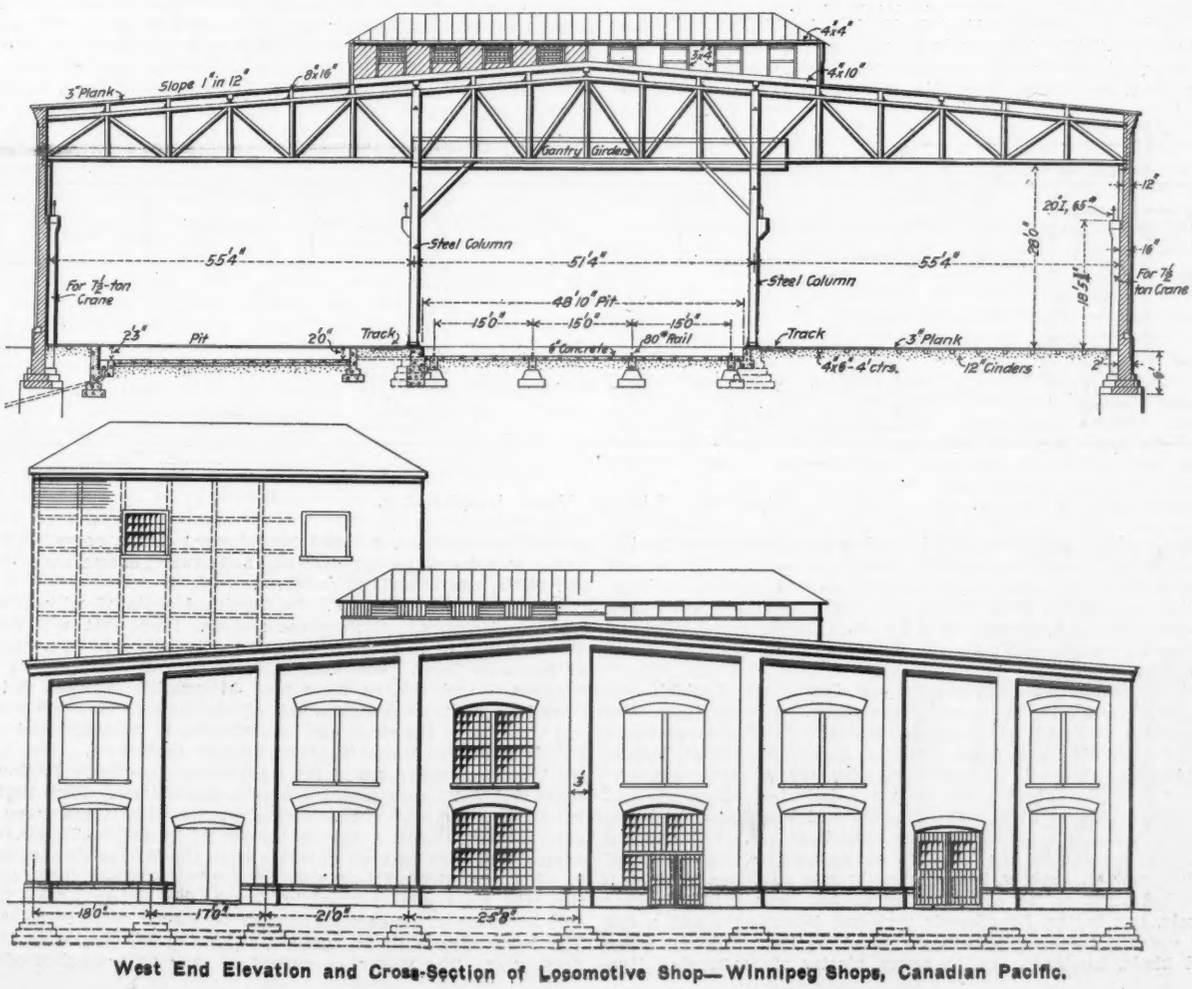
It may be of interest to point out certain features of the locomotive, machine and erecting shop at Winnipeg, in which it differs from other large shops recently built. As pointed out in the article this shop is intended solely for repair work and not for new construction, all of which is done at the new Montreal shop. The latter is of the usual longitudinal type, 1,160 ft. long, with one 80-ft. erecting bay and two machine shop bays 55 and 25 ft. wide respectively, the latter having also a gallery. The engines are handeld by two 60-ton traveling cranes of the usual pattern.

In designing the Winnipeg shops the writer believed that for the work to be done there a more economical type of shop could be built which would serve the purpose equally well. The plan proposed, which was adopted by the railroad company, is believed to meet these conditions and to be working satisfactorily in practice. The clear width of the building is the same as at Montreal, viz., 160 ft. It is, however, divided into three bays of nearly equal width, the central bay being 50 ft. and the side bays 56 ft. wide. The east end of the building, for a length of 440 ft. forms the erecting shop, while the west end for the entire width of the building is given up to the machine tools.

Owing to the very severe climate the electric transfer table is placed in the central bay between the transverse erecting pits which occupy the side bays. The transfer table is of the usual electric type, its pit being only 15 in. deep, with a finished concrete floor to facilitate passage across it. The construction of the roof is uniform for the entire length of the building so that the transfer table pit can be lengthened or shortened in the future if desired. All heavy traveling cranes are omitted, the heaviest moving crane being of 20 tons capacity; this is confined to the north bay of the erecting shop where boiler work is done. In all other parts of the side bays both in the erecting and machine shops the runways are designed to carry 10-ton cranes only. These light cranes run the whole length of the building carrying material direct from the machine shop to the pits. The wheeling and unwheeling of engines is done by a special hoist. This is placed over the central bay, that is, over the transfer table at a point opposite the track by which the engines enter the shop. Two heavy girders, 8 ft. between centers, are permanently fixed, forming a part of the structural frame of the building. On these fixed girders are two crane trolleys each of 50 tons capacity moving on heavy rails. These trolleys are in every way similar to the usual type of crane trolley, but their movement is controlled from the main floor. They are each fitted with one 30-h.p. and one 5-h.p., 3-phase electric motors for lifting and traversing respectively. The position of this hoist over the transfer table is in practice extremely convenient, as the engines remain suspended while the wheels are taken away on the transfer table and shop trucks are similarly brought to take their place. The economy in this style of shop is considerable. The roof construction becomes light and can be built either of timber or steel while where the weight and shock of heavy traveling cranes have to be supported very heavy structural work is required throughout the building. In many shops lately built the structural steel alone has cost over $1 per sq. ft. of floor area, or about half



East End Elevation and General Plan of Locomotive Shop—Winnipeg Shops, Canadian Pacific.



West End Elevation and Cross-Section of Locomotive Shop—Winnipeg Shops, Canadian Pacific.

the total cost of the building. In addition, the moving cranes are much more expensive than the hoist with fixed girders, as above described.

At Winnipeg, even after allowing for the space occupied by the transfer table under the shop roof, the saving was very appreciable. The plan and cross section herewith shown will make the general arrangement clear.

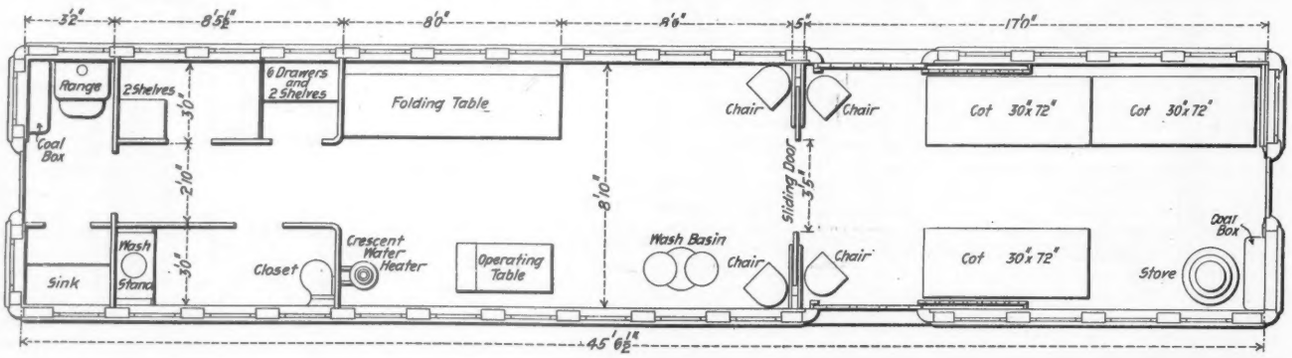
Lehigh Valley Hospital Car.

At Packerton, Lehighton and vicinity several thousand men are employed by the Lehigh Valley Railroad in the shops and yards, and as the nearest hospitals are at Allentown and Bethlehem, the railroad company has provided a hospital car for the prompt treatment of injured employees, which is located at Lehighton, where physicians can be had promptly and where the wreck train is also held. Ordinarily this car is used for the treatment of injuries to employees of the Packerton yards and vicinity, which are of such a nature that while they need surgical attention, they do not require the movement of the patient to a hospital. In case of serious injury, requiring movement to a hospital, a preparatory treatment is given before sending the patient. If the injury is serious after the preparatory treatment is given, the patient is removed from the hospital car and taken to the hospital by passenger train. If, however, the injury is sustained at a time when no passenger trains are due, and the injury is of such a nature that it is advisable to move the patient to a hospital at once, an engine is attached to the hospital car and the patient moved in that manner. In cases of accident on the road requiring the service of the hospital car, it is moved in connection with the wreck train.

The car has the following dimensions:

Length over sills	46 ft. 7 in.
Width over sills	9 " 5 "
Distance, center of bolster to end of sill	5 " 0 "
Width over all at eaves	10 " 0 "
Height, top of rail to under side of sills	3 " 9 "
Extreme length over platforms	52 " 7 "
Height, top of rail to top of platforms	4 " 2 "
Type of trucks	4-wheel
Wheel base of trucks	7 ft.
Body bolsters	Wood.
Heated	By stoves; except in train, then heated by steam.
Lighted	With oil lamps.
Type of platforms	Miller
Weight of car complete	51,600 lbs.

The inside finish of the car is of maple and walnut with canvas head lining. It is divided into two compartments, one of which contains a stove, two chairs, three cots, springs, mattresses, sheets, pillows and blankets complete. This is used as a reception room for the injured before and after receiving medical attention. The second compartment is used as an operating room and contains a large drop table, a stand with basins, two chairs, one enameled iron operating table, a Crescent water heater, a large, round, shallow, galvanized iron receptacle on the floor for soiled clothing, dressings and refuse.



Floor Plan of Lehigh Valley Hospital Car.

At one end of this compartment are closets, one of which contains a sink, buckets, basins and tin utensils. Another is a toilet and dressing room with lavatory and urinal. Another large closet contains extra tables, bedding, clothing, underwear, towels, splints and crutches. Two other closets contain surgical dressings, etc. Another closet is provided for the more delicate instruments and appliances. This is fitted with drawers which contain tin boxes in which are surgical dressings for immediate use. The surgical appliances carried in the car are very complete, consisting of crutches, splints, buckets, basins, stretchers, a sterilizer for instruments, hot water bottles of various kinds, bed pans, urinals, rubber blankets, pus basins, hypodermic syringes, tournequets and a full large operating case. Surgical dressings, cotton, ordinary gauze of all kinds, bandages, muslin gauze, plaster of paris, pins, ligatures, toweling, medicines, ether, chloroform, soda bicarbonate, salt, bichloride tablets, hypodermic tablets, emollients for burns, aromatic spirits of ammonia, carbolic acid, dusting powders, green soap, etc., are carried on the car. The car has been in service about five years.

Westinghouse Single-Phase Equipment for the Sarnia Tunnel.

The St. Clair Tunnel Company has awarded the contract to the Westinghouse Electric & Manufacturing Company for the complete electrical equipment of the single-phase alternating current system to operate all freight and passenger trains through the tunnel under the St. Clair river above Detroit, which connects the American and Canadian Divisions of the Grand Trunk Railway. The terminals of the tunnel are at Port Huron, Mich., and Sarnia, Ont., and the tunnel proper is 6,032 ft. long. It is single tracked but double-track approaches lead up to within 300 ft. of the portals at each end. The total distance to be electrically equipped from terminal to terminal is 19,348 ft.

At the present time passenger and freight trains arriving from either direction are hauled through the tunnel by steam locomotives. Nearly all freight trains are divided into two or more sections before entering the tunnel as they are too heavy for one locomotive to handle up the 2 per cent. grades at each end. It is expected that the use of electric locomotives will greatly relieve the congestion existing at the terminals as their greater hauling capacity and flexibility will reduce the division of trains to a minimum. The danger from suffocation from gases in the tunnel will also be done away with entirely. It will be remembered that a little over a year ago six trainmen were suffocated in the tunnel as a result of a train of 17 loaded coal cars breaking in two on the heavy grade and stalling.

The plans and specifications for the electrification project were prepared by Mr. Bion J. Arnold, Consulting Engineer of Chicago, who has been one of the pioneers in single-phase electric traction in the United States, and who is a member of the New York Central Electric Commission. The installation of the apparatus will be done under Mr. Arnold's supervision.

The equipment includes a complete power station containing boilers, stokers, coal and ash handling machinery, feed pumps, feed water heaters, condensers, water supply, fire protection and heating systems, piping, electric crane, steam turbine generating units, engine-driven exciting unit, motor-driven exciting unit, switchboard, feeder and distributing system, bridge and pole lines for catenary trolley construction, overhead work, bonding, transformers for power and light, light and power distributing systems, lightning protective apparatus, arc and incandescent lamps, roundhouse motors, motor driven pumps, drainage and sewer systems for buildings and yards, and electric locomotives.

Six locomotive units will be furnished equipped with Westinghouse series-wound, single-phase motors. Each unit will exert a drawbar pull of 25,000 lbs. on a 2 per cent. grade at a speed of 10 miles an hour. The locomotive units may be operated from either end and two or more may be coupled together and controlled in multiple from the cab of any unit so that the mechanical strength of the couplings between cars is the only limit to the size of train which may be taken through the tunnel.

The locomotives are of the rigid frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-in. driving wheels with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam locomotive practice will distribute the weight on the six drivers. The frames will be made of cast-steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear. The power equipment of each unit consists of three

250-h.p., single-phase, series-wound motors of the same general type as those recently adopted by the New York, New Haven & Hartford for its terminal operations in New York. Pneumatically operated trolleys of the pantagraph type will collect the current from the overhead trolley line outside the tunnel.

Alternating current at 3,000 volts, 25 cycles, will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire and pantagraph trolley to the locomotive equipment. The trolley wire will be hung by a catenary suspension from steel towers which span the track or from bracket arms mounted on lattice-work steel poles.

Shapes of Switch Targets.*

Replies to a circular sent to 60 different roads in 1904 have elicited information on the practice of 50 of these roads in 10 different particulars as indicated below.† After summarizing the information received, the Central of New Jersey adopted a switch target of the shape shown in Fig. 1, the stand being of the Ramapo pattern. This is the target as it appears when the switch is set for the side track. When it is set for the main line no target appears. This standard is the same as that which has been in use on the Philadelphia & Reading for some years.

Question No. 1. On double track are targets and lamps used on both facing and trailing point switches? Nearly all of the roads which have much double track answer yes. The Delaware & Hudson says no, except important trailing switches; on the Pennsylvania Lines West of Pittsburg they are used for facing switches only. The Atchison and the Southern Pacific are among those answering no.

Question 2. Do you use both safety and danger blades on the target? Nearly all roads answer yes; those answering no are the Chicago & N.-W.; Chicago Great Western; Chicago, M. & St. P.; D. & H.; Great Northern; Grand Trunk; Michigan Central; Northern Pacific; Phila. & Reading; Southern Pacific.

Question 3. Are the safety and the danger blades alike? Nearly all of the roads answer no.

Question 4. The answers to this question indicate that on nearly all of the roads the position of the switch is indicated by the shape as well as by the color of the target blade.

Question 5. The replies show that eight roads use switch targets in the form of a semaphore blade. These are the Chicago & Alton; Chicago & E. I.; C., M. & St. P.; Cincinnati, N. O. & T. P.; D. & H.; Lake Shore & M. S.; Lehigh Valley (on some facing switches); Missouri, Kansas & Texas (experimentally); Pennsylvania [west of Pittsburg]; Seaboard Air Line.

Question 6. Do you use a distant signal interlocked with switch-stand of facing point switch? Thirty-one roads use this arrangement, but do not say to what extent.

Question 7. Replies indicate that high tripod stands are used on the Baltimore & Ohio; Buffalo, Rochester & P.; Canadian Pacific; Central of Georgia; Chesapeake & Ohio; Chicago & Alton; C. & N.-W.; C. G. W.; C., M. & St. P.; C., R. I. & Pacific; Cincinnati, H. & D.; C., N. O. & T. P.; C., C. C. & St. L.; D. & H.; Illinois Central (in some places); Louisville & Nashville (in special cases); Michigan Central (where necessary); M., K. & T.; Missouri Pacific (in special cases); New York Central ("but not generally"); Pennsylvania Lines (replacing with semaphores); Southern Railway.

Questions 8 and 9. All of the roads replying use a lamp to indicate safety at night; 28 use white and 21 green.

Question 10. Do you consider the use of a white light as a fixed signal to indicate safety advisable?‡ Eleven roads answer in the affirmative, four are non-committal, and one has the subject under consideration; but 34 believe that the use of white is not advisable. These are the B. & O.; B. & L. E.; B., R. & P.; Burlington & M. R.; Canadian Pacific; Central of Ga.; Ches. & O.; C. & A.; C. & E. I.; C. & N.-W.; C., B. & Q.; C. G. W.; C., R. I. & P.; C., H. & D.; C., N. O. & T. P.; C., C., C. & St. L.; D. & H.; D., L. & W.; G., C. & S. F.; G., H. & S. A.; G. N.; I. C.; L. V.; M., K. & T.; M. P.; N. Y., N. H. & H.; N. P.; O. S. L.; P. M.; P. & R.; S. P.; S. L. & S. F.; U. P.; Wabash.

A number of roads with their replies sent drawings of their standard switch targets, and some of these we copy.

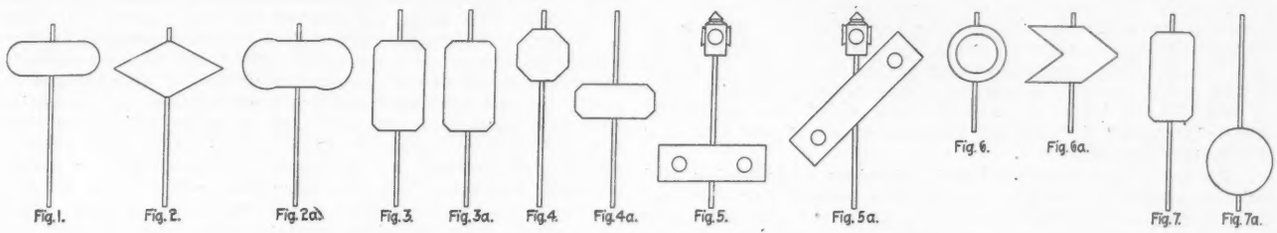
Fig. 1 is the standard adopted by the Central of New Jersey. The top of the target is 6 ft. 8½ in. from the surface of the ties. The target is 9 in. wide; extreme length 24 in.

Fig. 2 (white) and 2*a* (red) show the standard of the Bessemer & Lake Erie; height of top of blade 7 ft.; length of blade, 30 in.

Fig. 3 (white) and 3*a* (red) show the Delaware, Lackawanna & Western standard for facing points; height of top of spindle 6 ft. 11 in.; target 14 in. x 24 in.

Fig. 4 (white) and 4*a* (red) illustrate the target for trailing switches on the D., L. & W.; height of top of spindles 8 ft. 1½ in.

Fig. 5 is the red target of the C., C., C. & St. L., 10 in. x 2 ft. 6 in.; the white target (5a) is 10 in. x 3 ft. 6 in. The top of the red target is 16 ft. 6 in. high.



Standard Switch Targets of Central of New Jersey and Six Other Roads.

The C., N. O. & T. P. standard is similar to these, except that the white target has a black border and heavy black rings, while the red target has a white border and heavy white rings.

Fig. 6 (N. Y., N. H. & H.) shows for safety a green center with a white border. The red target (6*a*) measures 15 in. vertically. The height from the base of rail is not given; but it is about 7 ft.

Fig. 7, the Union Pacific white target is 12 in. x 24 in., and the top of the spindle is 7 ft. 5 in. high. Fig. 7*a* is the U. P. red target.

*Abstract of a paper on "Target and Lamp Signals Applied to Switches," by J. O. Osgood, Chief Engineer of the Central of New Jersey; printed in the November Bulletin of the American Railway Engineering & Maintenance of Way Association.

†Prominent roads which do not appear in the list are the Atlantic Coast Line, the Boston & Maine, the Erie, and the Pennsylvania.

‡The road which had the subject under consideration was the New York Central; but it has recently been announced that that company is to adopt green for all clear.—EDITOR.

The Past Year from an Interurban Standpoint.

The following review of the year 1905 from the interurban railway standpoint is taken from the *Interurban Railway Journal* of December 30 last:

During the year just closing there has been a marked improvement in methods of financing and construction of electric lines. With some of the early promoters it was more a matter of how cheaply a road could be constructed and how largely it could be bonded, than of providing for future development. Some lines were built along highways, using jointly county bridges cheaply constructed. The result was that an increase of traffic demanded heavier and better equipment and some roads were unable to operate because of light track, inadequate strength of bridges, and lack of funds to extend power stations. The interest on excessive bond and stock issues absorbed the revenues to such an extent that nothing was left to provide for increased facilities. The roads recently built have avoided these difficulties by more conservative financing and by being equipped at the outset for the heavy traffic that every well located electric line develops. Many electric lines that were built a few years ago, costing from $15,000 to $20,000 per mile, have a bond issue of from $30,000 to $38,000 per mile, in addition to stock allotments. At the present time there is a tendency to reduce the bonding of electric roads to three-fourths of their cost, requiring the promoters to furnish the right-of-way, franchises, preliminary expenses, and 25 per cent. of the cost of the road from the sale of stock securities, thus reducing the bond issue to the basis of real estate loans having a 25 per cent. margin. This will increase the value of interurban securities and tend to repress the promotion of "wild cat" lines.

The greatest amount of electric railway building during 1905 has been in the central western states of Ohio, Indiana, Michigan and Illinois, where numerous towns and the favorable topography of the country invite such enterprises. There has also been marked activity in some other states. In California, which is a land of magnificent distances, some very long lines have been projected with more reference to terminals than to intervening towns. The same is true generally of the new and less populous states of the north-

west. Readers of this journal must have been struck by the wide field covered by announcements of new interurban lines that are being built or surveyed. The last issue of this paper contained notices of such enterprises in Ohio, Michigan, Indiana, Illinois, Texas, California, Wisconsin, Tennessee, Pennsylvania, Kentucky, Delaware, South Carolina, Oregon, New York, Iowa, South Dakota, Maine, Massachusetts, Colorado, Nebraska, Georgia, Washington and Alabama, and the territories of New Mexico and Oklahoma. In every one of these states and territories from two or three to 12 or 15 new electric enterprises were reported, and this in only one issue.

The year 1905 has witnessed some notable improvements in the facilities of interurban lines. The rapid growth of the system in the central west has brought about new conditions of long distance travel, interchangeable mileage, sleeping cars, dining cars, and in the handling of local freight. Sleepers for interurbans are one of the latest innovations and are destined to become very popular in the future. In some cases where the run is not yet long enough to justify sleepers, parlor cars have been put on temporarily until long distance connections can be made.

Another progressive step of the present year has been the formation of plans for through interurban traffic, not only by interchangeable mileage on interurbans, but also in co-operation with steam roads. Some interurban lines have made traffic arrangements with certain steam roads whereby tickets may be sold at stations on the interurbans acceptable on steam lines to cities reached by the steam roads. This arrangement has worked satisfactorily to both parties and is likely to spread. It is one of the progressive steps of 1905. On the whole, the year has been one of great activity in electric interurban business, and the prospect is that 1906 will show still further development.

The new lines constructed and extensions made during 1905 make it possible to travel by trolley from western New York and Pennsylvania to the Mississippi river and beyond, and the closing of a gap in central New York will enable one to make a continuous trolley trip from Maine to Missouri. There are far-sighted electric railway men who believe the day is not distant when there will be continuous trolley connection between Portland, Maine, and Portland, Oregon, perhaps not by a direct route, but continuous.

There is a continuous trolley connection from Akron, Ohio, to Kalamazoo, Mich., 305 miles, and the connections are such that the distance can be covered by electric railway in less time than by steam, and at about one-third less cost. A trip from Indianapolis, Ind., to Zanesville, Ohio, 250 miles, can be made in one hour less time by electricity than by steam. All these long line connections have been made during the past year.

There is reason to believe that interurban interests have been injured and retarded by the attempted promotion of "fake" schemes. This has been the fate of other new business enterprises. Scores of steam railroad companies were organized that never built a mile of road, and it could hardly be expected that the electric interurban business would escape the same experience. It is a case in which the innocent must suffer for the faults of the guilty—that is, meritorious and legitimate enterprises for "wild cat" and illegitimate schemes. This cannot be altogether avoided, but at the present time there is an obvious tendency toward a more solid and settled order of things.

Among the distinctive features of 1905 must be mentioned the increasing popularity of interurban securities for investment. The general prosperity of the country causes a steady accumulation of wealth and of investment capital. This, in turn, causes a demand for safe securities based on properties of present and prospective value. Capital is proverbially conservative and sagacious and knows a good thing when it sees it. Reports from all the money centers of the country show an increasing demand for interurban securities for investment. On all the stock boards, where they are listed, the quotations indicate that the men who have money and who know how to invest it, regard this class of securities as among the best offered. There is no mistaking the meaning of the steady trend of capital in this direction. It means that capitalists recognize the solid basis and future growth of the interurban business.

A recent development in the business is the building of electric railway lines by steam companies. We do not refer to the electrification of former steam lines, but to the construction by steam companies of new electric roads between cities and towns which are reached by the steam lines, thus paralleling themselves with electric interurban lines. Several lines of this kind have been constructed or are proposed by prominent steam railroad companies of the east. This means, first, that they recognize the practical value of electricity as a motive power, and, second, that they propose to anticipate the construction of electric interurban lines by others by building them themselves. The construction of these parallel electric lines will undoubtedly draw off considerable local passenger traffic from the main lines, but as the electric lines will be owned by the parent company, this will not matter. Steam railroads depend mainly on freight traffic. The interurban trolley can live and thrive with only its passenger service as a source of profit, while to many steam railroads the passenger service is a source of actual loss. For a sum that it will cost a steam road to run a train every hour, the electric line can send out a car, if need be, every five minutes. Moreover, the trolley line has its terminals wherever a passenger wishes to alight, whereas many of the trains on the leading steam roads run through and the local trains stop only at regular stations, usually several miles apart. It is an open question whether the loss of local traffic is not a benefit to steam roads by affording them greater opportunity for the handling of freight and through traffic. We are of the opinion that steam railroad companies traversing populous sections of the country, show business shrewdness in paralleling portions of their route with electric lines, and they also virtually admit the superiority of electric lines for local and interurban traffic. The fact that they have entered on this policy should cause private capitalists, who contemplate building such lines, to lose no time, lest they be anticipated and shut out. If there is money for steam railroad companies in building such lines, there is money for those who would build them as independent lines.

Annual Report of the Michigan Railroad Commissioner.

The year just closed has been a prosperous one for the railroad companies doing business in the State of Michigan, the volume of business done being the greatest in their history. Although there has at times been some difficulty in furnishing a sufficient number of cars to carry the traffic offered, the business generally has been handled to the apparent satisfaction of shippers and the public, and but few complaints have been received. All complaints have been carefully investigated, and it has generally been found that the railroad companies were putting forth every effort to satisfy their patrons, and to handle as expeditiously as possible all traffic presented. Two companies have gone into the hands of receivers—the Pontiac, Oxford & Northern, running from Pontiac to Caseville, aboue 100 miles, whose troubles appear to have been caused by disagreement among its stockholders, and the Pere Marquette, serving a large portion of the state. This action has not, in either case, interfered materially with the business of the companies. The service rendered is and has been quite satisfactory, and material and important improvements have been and are being made by both companies.

The people of the State are much interested in the probable ultimate outcome of the receivership of tne Pere Marquette, and it is sincerely to be hoped that when the receivership shall have been terminated the ownership may pass to those who will be interested in its development and improvement, and that such ownership may be of a permanent, lasting character, and that the road may not thereafter be hawked and peddled about for speculative purposes as has been done during the past four years.

There is some sentiment that the issuance of all railroad stocks and bonds should be subject to the scrutiny and approval of state authority. It might be well to consider the advisability of making restrictions upon new companies organized under our laws by requiring them to do a certain amount of work upon their proposed lines within a specified time, in order to hold the rights and privileges granted them by their articles of incorporation. The necessity for this has been suggested by a case recently decided in the Monroe circuit, where it was claimed that a railroad company was organized and incorporated with a merely nominal amount of capital stock for the express purpose of preventing the condemnation of certain property by another company that is honestly striving, in good faith, to construct a railroad line.

Notwithstanding the great amount of business done, but few accidents have been reported involving loss of life or injury to persons.

Some of the recommendations contained in the last annual report of this department were enacted into law by the Legislature, a bill having been passed fixing penalties for the construction of a crossing of two railroad lines without the approval of the Board of Railroad Crossings, and another providing similar penalties for the building of a crossing of an electric and steam road before its approval by the Commissioner of Railroads.

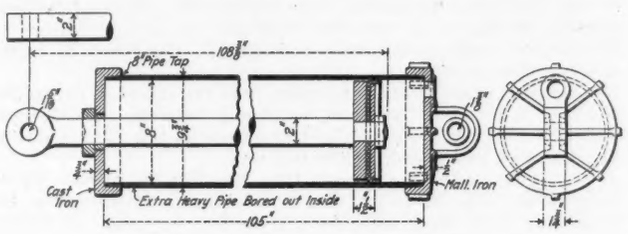
An amendment was also made to the law providing for the exercise of police power over electric railways, authorizing the Commissioner of Railroads to order fencing along the line of such roads whenever in his judgment it should be considered necessary, and also to order the necessary farm crossings over electric railway tracks.

While there has been much discussion throughout the country during the past year upon the subject of freight rates, there has been but little, if any, agitation apparent in this state, and but few complaints regarding the rates charged.

It is unfortunate that there is no law requiring electric railway companies to make official reports to this department, in order that definite information may be available regarding them. A number of new lines are in course of construction, a great many of the existing roads have built extensions during the year, nearly if not quite all have made important improvements, and all seem to be doing a successful and prosperous business.

Coal Pusher for Locomotive Tenders.

The accompanying illustrations show a recent labor saving device applied to the tenders of large locomotives. It is what is known as a coal pusher and is located at the rear end of the tank coal space, for the purpose of pushing the coal toward the front end as often as the fireman needs a fresh supply. The device was first applied to the tank of engine No. 924 on the Atchison, Topeka & Santa Fe in August, 1904. Since that time 27 locomotives built by the company at its own shops have been equipped, and on a recent order completed at the Baldwin Locomotive Works 20 more were put on. These locomotives haul freight over the long western divisions where it is necessary to carry a large supply of coal, and the pusher has proved to be of considerable assistance to the fireman.



Air Cylinder for Raising Apron.

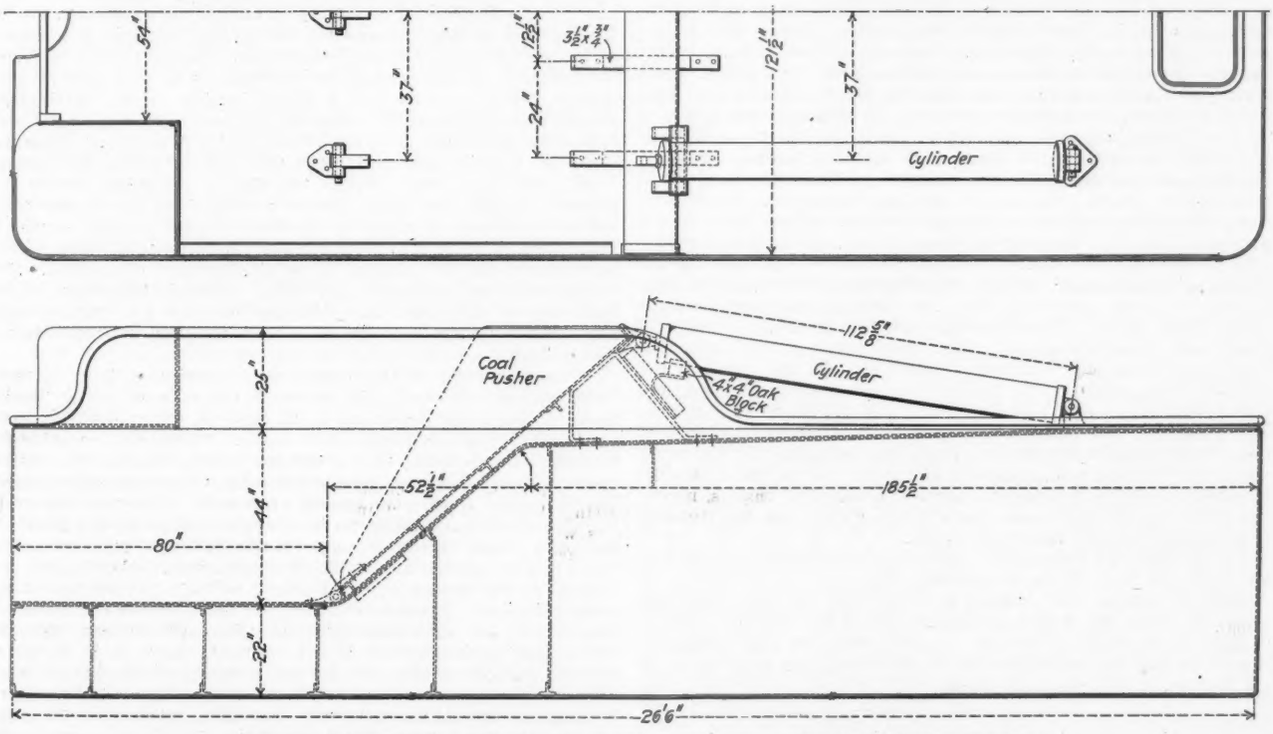
The apparatus consists of an apron made of ¼-in. steel plate, which in its regular position forms the back end of the coal space being inclined at an angle of 45 deg. with the floor. The lower part of the apron is attached to the floor by three pins which permit it to swing about them as a center. Fastened to the top of the plate and to the rear are two cast-iron lugs, which are in turn attached to the piston rods of two long 8-in. cylinders. These cylinders are anchored at the back end in such a way as to permit a slight turning motion as the plate is swung ahead.

When the fireman needs coal pushed to the front, instead of climbing to the top of the pile and shoveling it down, he turns a small valve and admits air enough to push the apron and coal the required distance forward. The tank shown has a water capacity of 8,500 gallons, and a coal capacity of 10 tons.

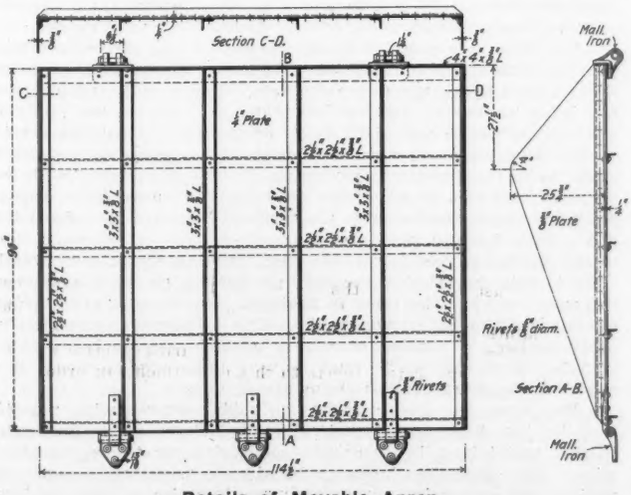
The St. Paul's Pacific Extension.

The *Wall Street Journal* quotes Capt. W. E. Pedrick, of New York City, President of the Western Anthracite Coal & Coke Company, as follows in regard to the route of the Chicago, Milwaukee & St. Paul's new line to the Pacific:

The route from Evarts, South Dakota, northwesterly into Custer County, Montana, will have no difficult grades, but a worthless, non-producing country to enter. Unless the line parallels the Northern Pacific up the north bank of the Yellowstone and Gallatin rivers there will be more expensive construction and a poorer country to traverse for local traffic except for the spring and fall shipments of live stock, until Deer Lodge valley, the prettiest valley in the state, is reached and the Butte region with its mineral tonnage. From there on, heavier grades and construction work are necessary across the Bitter Root range, where St. Paul engineers and Northern Pacific engineers are now battling with each other up to their necks in snow for precedence over Lolo Pass. From the Pass the St. Paul surveys run down a fork of the Clearwater river and to the western line of Idaho in the neighborhood of Lewiston, whence a spur north to Spokane is probable. Approximating the foregoing route, articles of incorporation of the Chicago, Milwaukee & St. Paul Railway Co. in Montana, were placed on record last week in Silver Bow County defining the route through Custer County on the east, and thence through Rosebud, Carbon, Yellowstone, Fergus, Broadwater, Jefferson, Madison, Silver Bow, Deer Lodge, Powell, Granite and Ravalla, the border counties of Montana, on the west. The location of the west end in Montana will doubtless be on the Snake river near Lewiston, Idaho; thence from a point near Lewiston, Idaho, west to Wallula, thence northwest to North Yakima, thence to Seattle, a total distance from Evarts of 1,558 miles. This estimate of distance over government land based on government township scale, plus 25 per cent. for development, is nearly correct, as is proven by both the Northern Pacific from St. Paul to Seattle, and the Union Pacific from Council Bluffs to the old 1,000-mile tree near Ogden. There are no wheat fields



General Arrangement of Device for Pushing Coal Forward in Locomotive Tender.



Details of Movable Apron.

as in the eastern Dakotas, and the former immense yields to the acre which gave such impetus to the building of the Northern Pacific, have now dwindled to that of Ohio, or perhaps less. From Spokane west, a rolling prairie country has the appearance of the semi-arid lands of the states west of the 100th meridian, for instance, near Pierre, S. Dak.; North Platte, Neb.; Garden City, Kan., and Washburn, Texas. But in the state of Washington this semi-arid land yields fine crops of wheat and furnishes a million bushels for shipment at one station, though mixed farming would fare as badly for lack of rainfall as in the Dakotas west of Evarts. It is the same south of this parallel from Dakota to the Rio Grande border in Mexico. Therefore there is not much to expect from local traffic until new precious metal mines are discovered, which is not unlikely in western Montana, as has happened recently in Nevada. Before Pasco is reached the opportunities presented through plenty of water for irrigation for a rich agricultural region are unsurpassed. The entire Yakima Valley has special possibilities. The altitude is but a thousand feet, more arid than Colorado, rainfall often but six inches, a delightful climate with energetic farmers pouring in every year, buying untouched soil at high prices, and paying for it from two years' crops. It is only 40 miles from this arid climate west to the peaks of the Cascade Range where there is rainfall in abundance and the vapors from the Pacific ocean hug but do not cross the mountain passes. Great veins of anthracite coal appear south of Mt. Ranier after crossing Cowlitz Pass. The St. Paul can, as the Northern Pacific does, continue to Seattle from Tacoma, or reach Seattle by branching off on the Natches river around the east side of Mount Ranier. It is well enough to note what has been done this year as to terminals for possible transcontinental lines: First, there is the Pacific Railway, which filed corporation papers in December. Its route is from Seattle southeasterly through North Yakima and Yakima Valley to Wallula, Washington, on the Columbia and touching the Oregon Short Line. This would serve for the northern route of the Chicago, Milwaukee & St. Paul. Next, we have the Spokane & Columbia River Railway & Navigation Company, its route from Spokane through Spokane, Whitman, Adams and Franklin Counties to Wallula. This would also answer the St. Paul for its Spokane connection. Then there is the North Coast Railway, starting from the Yakima river on the north side of the Columbia near Kiona, Wash., on the Northern Pacific, thence up the Yakima through North Yakima and up the Natches to the foothills of the Cascade Range, over Cowlitz Pass through the coal fields and down the Carleton and Cowlitz rivers on the west slope. Three surveying parties have performed diligent work there this season. They have halted at the anthracite coal fields, where they can look westerly and see the smoke of the locomotives at Ashford, the terminal of the Tacoma Eastern, and its paying lumber and coal business. The purchase three months ago of $700,000 wharfage and tidewater flatlands at Tacoma, in addition to the transfer of 640 acres more last week, for the former of which the St. Paul gets the credit by rumor, and for the latter Mr. Harriman, and the 20 miles of completed grading of what is known locally as the "Donald" road from North Yakima up the Natches, is the record of work done this season.

Capt. Pedrick's estimate of 1,558 miles as the length of the new St. Paul line from Evarts to Seattle, added to the 796 miles from Chicago to Evarts over existing St. Paul lines via Milwaukee and La Crosse, Wis., and Hastings, Minn., would make the distance from Chicago to Seattle 2,354 miles as against 2,260 miles from Chicago to Seattle by the Burlington and Great Northern, and 2,344 miles by the Burlington and Northern Pacific.

New Interurban Connecting Link.

The two most important groups of electric interurban lines in the country—the one group composed of the roads along the southern shore of Lake Erie and in eastern Michigan, connecting the cities of Erie, Pa.; Cleveland and Toledo, Ohio, and Detroit, Bay City and Kalamazoo, Mich., and the other of the lines about Columbus, Dayton and Cincinnati, Ohio, and Indianapolis and Fort Wayne, Ind.—although not far distant from each other at several points, have until recently had no actual physical connection. On December 30 last, a 30-mile connecting link from Findlay, Ohio, on the north, to Lima on the south was completed and put in operation. This brings into connection 70 electric interurban roads with a mileage of over 3,700 miles, which figure is exclusive of more than 1,000 miles of city lines. Of these 78 roads, 48, with a mileage of 2,261 miles, are in Ohio; 11, with a mileage of 888 miles, in Indiana; eight, with 482 miles of line, in Michigan, and three, with 75 miles, in Pennsylvania. By using the new connection, it is now possible to travel by electric railroad between the extreme points of Titusville, Pa., southeast of Erie, to Crawfordsville or Columbus, Ind., respectively northwest and south of Indianapolis, a run of something over 600 miles. A journey from Bay City, Mich., south to Cincinnati, nearly 400 miles, also becomes possible, this by even more direct line. Further extensions and rounding out of the present territory of interurban lines in the central west is going on rapidly.

Railway Signal Association.

The January meeting of this Association was held at the Grand Union Hotel, New York City, on Tuesday, the 9th, President C. H. Morrison (Erie) in the chair. Some 60 members were present. About 30 new members were elected. The change in the constitution, proposed at the last meeting, was adopted, and the Association now has two Vice-Presidents, Mr. A. H. Rudd (P. R. R.) being elected at this meeting. The meeting also adopted the proposed change in the by-laws, Article 6, under which associate members henceforth will have only those privileges which are accorded to honorary members. Mr. G. M. Basford, now with the American Locomotive Company, and who was the originator of the Railway Signaling Club (which in 1903 became the Railway Signal Association) was elected an honorary member of the Association.

The Executive Committee reported that the digest of the proceedings for the years 1895-1905, inclusive, would be published in two volumes, aggregating some 1,400 pages. These will be issued in about three months.

The first paper on the programme was the report of Committee No. 4, I. S. Raymer, Chairman, on storage batteries. Mr. Raymer reviewed what had been done by committees on this subject during the past four years, and, continuing, said:

"Leaving out at the present time the question of cost, on account of the difficulty in arriving at a fair basis of calculation, the committee is of the opinion that, from the standpoint of service rendered, storage batteries are preferable for block signal work, on account of their uniform and continuous supply of current as compared to the weakening or failing of caustic soda batteries, due to the approach of their exhaustion, and to the interruption in signal operation while renewals are being made. On the P. C. C. & St. L. the 'primary storage' method of charging is in use. Six cells of storage battery are used at a signal location, a set of eighteen gravity cells are connected in series; positive of gravity is connected to positive of storage, and negative of gravity to negative of storage. The e. m. f. of the gravity is great enough to overcome the counter e. m. f. of the storage. While the signals are going toward the proceed position the motors receive current from the storage cells, but when signals are standing in either proceed or stop current is being supplied from gravity to storage. Experience of three or four years has shown this method to be practical and economical. The storage cells are apparently in a better condition than those of the same age on the power line. Storage batteries for track circuits have been in service long enough to show that they are well adapted for the work." * * *

The discussion of this report was participated in by Messrs. C. C. Anthony (P. R. R.), M. E. Smith (D., L. & W.), C. C. Rosenberg (L. V.), A H. Rudd, and D. M. Case (C., N. O. & T. P.); also by Messrs. Bezer, Reynolds and Leslie. There was considerable testimony to the effect that a storage battery charged for several years at only a moderate rate deteriorates, the positive plates tending to buckle Experience has shown that to counteract this every battery ought occasionally to be charged at the normal rate. If necessary, there should be an extra gasolene generator to insure being able to charge at a sufficiently high rate. Surprise was expressed at the success on the P., C., C. & St. L., mentioned in the report; but Mr. Raymer said that the same arrangement was in use on his road, the Pittsburg & Lake Erie. The storage batteries which have been in use on 40 or 50 miles of the D., L. & W. for 10 months past have thus far given uniformly satisfactory results. The power wire on this line is No. 10, B. & S., hard drawn copper. To some of the signals the power has to be transmitted 10 miles, and the current is from 2 to 2.5 amperes. Mr. Smith in future installations proposes to use a 6-h.p. gasolene engine and a 3-k.w. generator instead of 4 h.p. and 2.5 k.w. The Pennsylvania uses for its power transmission a No. 6 wire; distance, 12 to 15 miles.

Mr. Case uses portable storage batteries, and therefore always charges them at the normal rate. He has 75 signals thus operated. Each maintainer keeps two extra sets, for use while regular sets are being re-charged. These are taken out, sent to the charging station, charged in one night, and immediately put back in service at the same place. A number of members appeared to be still in doubt as to the conditions governing the use of portable batteries; on what kind of a line are they desirable and economical? On the Southern Pacific the batteries are carried to and fro on independent motor cars, but the use of such cars is objected to in some cases where the line of road is very crooked. Sending batteries by freight train is objectionable because they get broken, and in baggage cars the space occupied by them is grudged. No one had definite data on this question of transportation. The Michigan Central has recently ordered a number of sets of portable storage batteries for signals. These are to be used in very light service, where it is expected one charge will last a month or more.

Mr. Ames, for the committee on rubber-covered wire, reported that he had been negotiating with the officers of an inspection bureau maintained by insurance companies for testing insulated wire. The committee hopes to be able to recommend some convenient and economical means of inspecting wire so that the large

railroads will not have to keep their own inspectors at the wire factories, and so that smaller roads can have independent inspection at reasonable cost.

The next business was a short paper by Mr. G. K. Rogers, of India, a member of the Association, describing the Mackenzie & Holland improved Sykes block signal apparatus used on the East Bengal State Railways. This was read by the Secretary, and a vote was passed thanking Mr. Rogers for the paper.

Next Mr. H. W. Lewis (L. V.) read a paper on the care of storage batteries. Mr. Lewis said in substance:

"It is important that the initial charge should be full and complete, and for that reason it should be continued until both the specific gravity and voltage cease to rise; then discontinue the charge and immediately adjust the electrolyte to the proper density as recommended by the manufacturers and mark the height of the electrolyte on the cells (a file mark is preferable, as it is permanent). Then discharge the battery about half and follow this discharge by a regular eight-hour charge, keeping the electrolyte at the proper height during this charge by the addition of distilled or other known chemically pure water to compensate for the water thrown off by evaporation; and if at the end of the charge the specific gravity has risen to the fixed density and remained there for at least half an hour, it will insure beyond a doubt that the battery is fully charged.

"The only reliable indication of charge and discharge is the specific gravity of the electrolyte. While no fixed figure can be laid down, it can readily be ascertained in each individual battery by observing the lowest specific gravity at which the device can be operated at the minimum voltage on closed circuit. This once attained and a reasonable margin allowed, a fixed minimum specific gravity is established. I have found that, charging on this basis and everything going smoothly, we are able to designate regular days for charging.

"As the density of the electrolyte varies materially with the temperature, it is therefore necessary to note that a battery having a specific gravity of 1.200 when fully charged at 60 deg. F. would need to be of nearly 1.2096 specific gravity at a temperature of 30 deg. F. and nearly 1.1872 at a temperature of 100 deg. F., and so on. In general no attention is paid to housing batteries with a view to a uniform temperature, and therefore it is an all-important feature that the temperature be watched as well as the specific gravity during charge and discharge, and that the electrolyte be maintained at the predetermined height and adjusted at a temperature of 60 deg. F.

"The irregular discharge rate at which batteries are subjected to in this line of work has a great deal to do with amount of current required to re-charge them, the discharge varying from hours to days, weeks and months. I might cite a battery whose discharge covers a period of six and one-half days, and as a rule it requires twelve hours at the normal rate to charge it; another whose discharge continues for 39 days requires 29 hours at normal rate, while a battery discharged in two or three days can readily be charged in eight or nine hours at normal rate; the efficiency of such batteries is greatly reduced.

"It is important that batteries in this class of work be not discharged too low. In this condition they sulphate more rapidly, and there is grave danger of buckling the positive plates on charge. The only cure in sight for this bothersome sulphate is incessant charging. This, of course, does the battery no good; as the sulphate, falling, carries quite a lot of active material with it."

The discussion on this paper was participated in by Messrs. Ames (L. S. & M. S.), Waldron (Interborough), Smith (D., L. & W.), Yocum (P. & R.), Arlington, Willis, Corey, and others. In setting up new batteries they are charged all the way from 100 per cent. to 200 per cent. of their normal capacity; some immediately discharge the battery and then re-charge, while others put the batteries at once in service on the first charge. On the Interborough batteries are charged to 200 per cent. at half the usual charging rate. The results have been remarkably good. Mr. Yocum has been charging at 200 per cent. for eight years or more, and the batteries are still in good condition. On the Lake Shore & Michigan Southern certain batteries which have very light duty are occasionally discharged into a rheostat so as to keep them in good condition. Commenting on this, Mr. Corey remarked that by the use of a rectifier, such as is used in charging automobiles from a. c. lines, it would be unnecessary to thus waste half the current; nearly all of it could be used. In this process a mercury vapor tube is used, which allows current to flow one way but not the other. Replying to a question, it was said that the mercury vapor tube is not excessively costly. A tube which, with its panel, is about 5½ ft. high and weighs about 150 lbs., is good for 1,000 hours.

At the afternoon session Mr. F. F. Fowle, of the American Telephone & Telegraph Company, read, by invitation, a paper on Specifications for Line Wire. Mr. Fowle went thoroughly into the details of his subject, most of his experience having been, however, with telephone lines. The discussion which ensued had to do principally with weather-proof insulation for line wires. It would seem that a number of roads have within the last few years bought considerable quantities of double-braid weather-proof insulated wire on which the insulation proved to be of poor quality, and there was considerable sentiment in favor of using bare wire because of the impossibility of securing good braid; but one of the wire manufacturers cleared the atmosphere by stating that not only his company but, he felt sure, a number of others were ready to furnish a good quality of weather-proof wire whenever the railroads should present the proper specifications. Not only this, if the railroads will agree upon standard uniform specifications the manufacturers will make the principal sizes of wire, with double and triple braid, and keep sufficient quantities in stock to promptly supply all demands.

Mr. Ames is satisfied that with No. 12 wire, double braid, it is necessary to have at least 60 poles to the mile. A number of members felt sure that No. 10, double braid, is the smallest size that should be used. No. 12 wire, triple braid, supported by 80 poles to the mile, has been found to last a satisfactory length of time.

A number of members were satisfied that weather-proof insulation could be depended upon only for currents of low voltage. Where these wires have fallen across telegraph wires carrying stronger currents the insulation did not prevent a cross.

Mr. Anthony had heard of instances of very faulty wire recently found in service. In one lot there were connections so poor as to almost destroy the conductivity, the insulation at the same time being so clumsily done that the faulty splices were quickly discovered. In another case the maker had made scarfed joints. These joints were soldered and the insulation carried over them so nicely as to conceal the faulty work. A lot of this wire broke in service. Two roads which have used insulated line wire for many years and extensively are the Lehigh Valley and the Philadelphia & Reading. The officers of these roads are settled in the opinion that bare wire must not be used; but as to just what size of wire and quality of insulation is most desirable their opinions are not so definite. A No. 10 copper power line, with triple braid, put up about one year ago on the D., L. & W., with 35 poles to the mile, broke in five places the first winter. This is the record for 142 miles of wire.

Mr. Anthony: This has been a most profitable discussion, and it shows clearly the need of united action looking toward standard specifications and adequate inspection. Very few roads buy enough wire to warrant independent efforts in this line, hence the necessity of associate action.

The Manipulation of Tool Steel.*

When any number of tools are to be made I have found it a good practice to forge tools first, and let them get quite cold before tempering them. I work the steel at as low a heat as possible and as quickly as possible but not with a heavy blow as is sometimes given by careless workmen under a steam hammer, as this destroys the grain by crushing it. Consequently when the steel is tempered, it will develop what are called tempering cracks. It is better to forge the tools with a sledge or a belt hammer, such as a medium sized Bradley hammer, as with these the tool can be shaped without injuring the texture of the steel. To temper the tool I heat it just hot enough to give it sufficient hardness, plunging it in a cooling mixture, gradually down to the upper end of the red, then pulling it out gradually. This will give a tapering from a low red at the upper end to a cold point, leaving the tool without any or with but very little contracting strain. Then I ease off the temper to the desired color, and generally speaking, if the steel is of an ordinary good quality the tool will be good. This is our practice for lathe, planer, slotter, twist drill, reamers, rose bits and such like tools made out of high carbon steel. Miller cutters and such tools we forge the same way, but in tempering we use a small charcoal furnace, and lay our tools in the furnace on a good bed of fresh red coals; then we put more coal on top of them and close the door of the furnace, letting the cutters get hot as the coal burns up, while the tool dresser is at work on other tools. When the cutter becomes hot we plunge it into a tempering liquid slightly heated. To draw the temper we place a piece of ordinary plate iron on the bed of charcoal which is left in the furnace. The cutter is then placed on this plate until it is slowly heated throughout. It is surprising how nicely this method will draw the color.

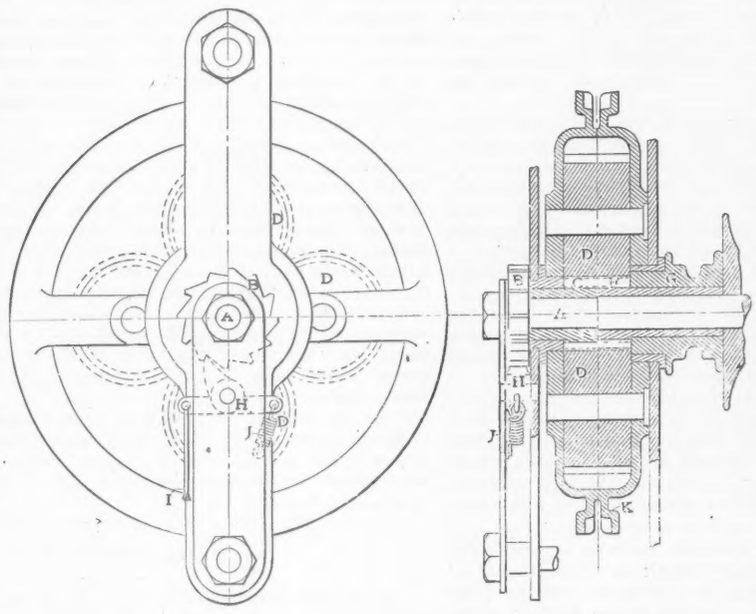
For high-speed tool making we have five different makes of steel, and they all have their own little peculiar differences of texture, consequently a little different way of working is necessary. These little points of difference have to be picked up by the tool maker. In forging a tool we generally follow the directions given us by the manufacturers of the steel, but in hardening the tool is where the difficulty lies, for I have found that this kind of steel deteriorates rapidly by tempering, that is, it gets soft

*From a paper by Arthur Stockall, Master Smith, I. C. R. Works, Moncton, N. B., read before the National Railroad Master Blacksmiths' Association.

in its texture as though some of its chemical parts have lost their cohesion, after two or three times tempering; this is due, I think, to the high heat necessary for hardening by air blast. The point for us to discover is, how to harden this steel at a low heat, and thus preserve its quality. I have tried the ordinary tempering mixture and also warm water. The steel will crack easily. With oil it is better, but not hard enough for hard tires and ends like the air blast in a softer tool.

I am now experimenting with a liquid that certainly makes the tool hard enough at a greatly reduced heat, but whether it will keep its cutting power I am not prepared to say at present, but our practice is for lathe, planer and such machines, and where speed is high and material hard to harden in an air blast at white sweating heat. For wheel boring cutters I have an air blast made of copper pipe which straddles the tool. This is softened so that it will bend easily, so that it can be readily adjusted to suit any length of tool. I also have a pair of tongs with broad jaws with which I grip the tool in the middle and put it in the fire and heat only both ends. I then place the cutters between the ends of the blast pipe and gradually turn on the air, and in this way cool off both ends at once, leaving the center at its usual temper, and I must say that the tools made in this way work splendidly. For taps, reamers, twist drills, miller cutters and such like tools that have to be finished to a cutting edge before tempering I have used the lead bath for heating and cooling in air where convenient and in oil when necessary, but when air is used great care must be taken or the fine edge will be blown off, but the lead bath, where only one or two pieces are to be tempered, is very slow and inconvenient. I have found the following plan very good in this kind of work: I mix some fire clay very thin, almost to a liquid, then I heat the tools just warm, not red, and dip them in the fire clay, then I pull them out and let them dry which only takes a short time. Repeat this until you have a layer of clay on the tool sufficient to protect them from the heat of the fire or blast, $^1/_{16}$ in. or $^1/_8$ in. thick is plenty. Then place them in the fire and heat them to the desired point and cool them by a blast or in an oil bath.

The Acme Chain Hoist.



Details of the Acme Hoist.

Iron and Steel in 1905.

The year 1905 was not only the most productive and the most prosperous year in the history of the American iron trade but it was the most uniformly prosperous year. From January to December the demand for all leading forms of iron and steel and for the raw materials of their manufacture was continuous and insistent. There was no "dull season," no overloading of the markets, no slump in prices. Upon the other hand there was no great scarcity of iron and steel at any time, the markets in the main were well supplied, and consequently there were no "famine" prices. Few orders were sent abroad and our export trade was not neglected. Production was abnormally and phenomenally great, but best of all prices were wisely kept within reasonable bounds. We have heard of no complaints that prices were too high. We estimate the year's production in round figures at about 43,000,000 tons of iron ore, 23,000,000 tons of pig iron, and over 3,000,000 tons of steel rails. Even these extraordinary figures may be exceeded in 1906. The present outlook certainly justifies this opinion. The country is increasing its capacity to meet any possible demand that may exist in the near future for either pig iron or manufactured iron and steel. There were no strikes or lockouts in the iron trade in 1905 that are worthy of mention.—*Bulletin of the American Iron and Steel Association.*

The Acme Chain Hoist.

The accompanying illustrations show the Acme chain hoist made by the Franklin Moore Company, Winsted, Conn. The hoist, as shown in the line drawing, is equipped with differential gearing by means of which it is possible to lift a weight equal to the full capacity of the blocks. The gearing is arranged so that by throwing a pawl out of engagement with the ratchet the lower block can be raised or lowered at increased speeds, as in taking up slack or adjusting slings, etc. The arrangement of the differential gearing is clearly shown in the line drawing.

Through the center of the hand chain wheel is a shaft, *A*, upon which two sleeves are mounted. The gear *C* is mounted upon the same sleeve as the ratchet wheel *B*, and the gear *F* is mounted upon the same sleeve as the chain-wheel *G*. These gears are of the same diameter, but *F* has fewer teeth than *C*. In operation the pawl *H* locks the ratchet and gear *C*. When the hand-chain is pulled it causes the differential gears *D*—which mesh with both the gears *C* and *F*—to revolve around *C* and also to rotate on their axes. As the gear *C* has more teeth than the gear *F* it is obvious that by the time the chain-wheel has made one complete revolution around *C*, *F* will have advanced the amount of their difference and have turned *G* with it. When the pawl is released from the ratchet, the differential gears are free to revolve independent of the hand chain-wheel, thus permitting the unloaded hook to be raised or lowered instantly.

Lake Flour Tonnage.

The *Northwestern Miller* prints the following tables to show the quantity of package freight, chiefly consisting of flour, shipped eastward via the different lake ports from the opening of navigation to Dec. 16, 1905, in tons:

Companies.	Ports on Lake Michigan.	Ports on Lake Superior.	Total Tons.	Total Per cent.
Lake Season of 1905.				
Western Transit	213,425	226,395	439,820	27.8
Union Steamboat	162,690	.....	162,690	10.3
Erie & Western	291,000	105,765	396,765	25.0
Mutual Transit	.....	184,595	184,590	11.7
Lackawanna	51,050	.....	51,050	3.2
Lehigh Valley	239,680	.....	239,685	15.1
Soo Steamship	109,520	.....	109,520	6.9
L. & Green Bay	.....	.....	.....	....
Total in tons	1,067,365	516,755	1,584,120	100.0
Lake Season of 1904.				
Western Transit	119,211	172,907	292,118	29.1
Union Steamboat	86,957	.....	86,957	8.7
Erie & Western	174,616	51,499	226,115	22.5
Mutual Transit	.....	159,023	159,023	15.8
Lackawanna	33,727	.....	33,727	3.4
Lehigh Valley	136,626	.....	136,626	13.6
Soo Steamship	65,331	.....	65,331	6.5
L. & Green Bay	3,813	.....	3,813	0.4
Total in tons	620,281	383,429	1,003,710	100.0
Lake Season of 1903.				
Western Transit	208,437	244,066	452,503	26.6
Union Steamboat	118,050	.....	118,050	6.9
Erie & Western	259,605	121,514	381,119	22.4
Mutual Transit	.....	180,059	180,059	10.6
Lackawanna	76,338	.....	76,338	4.5
Lehigh Valley	258,950	.....	258,960	15.2
Union Transit Co.	.....	83,111	83,111	4.9
Soo Steamship	145,463	.....	145,463	8.6
L. & Green Bay	5,855	.....	5,855	0.3
Total in tons	1,072,708	628,750	1,701,458	100.0

GENERAL NEWS SECTION

NOTES.

The Committee of the lower House of Congress on Interstate and Foreign Commerce will report favorably the Mann General Bridge bill. This bill codifies all the existing Federal statutes relating to bridges, and provides that hereafter bills merely stating where the bridge is to be constructed shall be considered by Congress, it being understood that all bridge statutes apply to bridges constructed with Government sanction. The Stephens bill extending the length of time live stock may be kept in cars will be the subject of hearings January 23 and 24.

The National Lines of Mexico will place in service January 16 a semi-weekly through limited train between St. Louis and the City of Mexico via Laredo, Tex., on a 59-hour schedule. The equipment is to be entirely new and of the best possible character. A tourist car service will be inaugurated this month also. The General Passenger Agent of the National Lines, Mr. Geo. W. Hibbard, recently with the Duluth, South Shore & Atlantic Ry., has initiated these new features in connection with an effort to colonize the southern part of Mexico. An advertising department has been created and will be in charge of J. A. Ball, for two years past Assistant Advertising Agent of the Chicago, Burlington & Quincy.

The American Institute of Electrical Engineers Building Fund.

The General Electric Company in view of the great importance and utility of the United Engineering Building, as a home and center for the engineering professions and arts, has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which had already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now, with other new subscriptions, well over $100,000, and with renewed energy the committee has begun its canvass of the field with the object of securing the second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to members a handsome pamphlet describing the new building.

A Plain Tale from the Corridor.

From the speeches that floated over the transom of the executive room of the Governor's office at the State House to-day it was evident that the representatives of the Central Passenger Association, called to participate in a conference with reference to a simpler form of mileage book, were trying in every possible way to do a great deal of talking and say nothing. In fact, Governor Hanly accused them of so doing, in effect, when he was heard to interrupt one of the speakers with the remark: "What I want you to do is to stop all the fol-de-rol talk, and get down to business." The speakers for the railroads spoke all around the subject. They contended that whatever Indiana's executive might do, it would not be binding for the other states in the association; that Governor Hanly did not have the right to try to regulate the affairs of the other states; that the present railroad commission law made any sort of a mileage book illegal, because it was a discrimination in rates; that the present system was fair. In fact, so many phases of so many subjects were introduced by the various speakers that time and again Governor Hanly was heard to say:

"Gentlemen, the proposition is very simple; what we want is a just modification of the present form of the interchangeable mileage book, one that is good on the train, and one that costs only $20. That is all there is up for discussion."

Several representatives of various travelers' associations spoke, all upholding the Governor in his contention that the present plan was unjust and unnecessary. One speaker pointed out that on one road, east of Pittsburg, the mileage was good on the train, and on the same road, west of Pittsburg, the mileage had to be exchanged.—*Indianapolis News, Dec. 29.*

A Faux Pas.

When the construction gang of the James' Bay Railway, which is being built from Toronto to Sudbury, encountered three narrow streams of water at Bala, at the western end of the famous Muskoka lakes summer resort, they apparently thought that nature had been unduly generous. Accordingly, they proceeded to fill up the first channel, and to bridge the second. Their plans with regard to the three had not developed when the Ontario government was notified, and a sudden halt was called to the whole procedure.

The railway engineer in charge had not realized that three channels at Bala are the sole outlet of the whole Muskoka Lake region, and that being very narrow, their capacity is often severely taxed. In the old days there were only two channels, and then the lake region was subject to disastrous freshets which would carry away boathouses, etc., and work damage wherever the rising waters reached. Accordingly the government constructed a third channel and there is a system of movable dams, by which it is sought to regulate the lake level at the varying seasons. The government when notified of the railway's action, at once informed the company that it must clean out the channel that had been filled. The channel on either side of the central pier must be excavated so that the large boats may sail into Bala, as they have been in the habit of doing. The government has been notified that the work of reclaiming the channel would be begun to-day.—*Ottawa Citizen.*

Manufacturing and Business.

In order to meet the demand for its new improved types of milling machines the Kempsmith Mfg. Co., Milwaukee, is building a two-story addition to its shops.

The new Robb-Mumford Boiler Works, South Framingham, Mass., has installed four electric Northern traveling cranes and several electric riveter hoists made by Northern Engineering Works, Detroit, Mich.

At a meeting of the Board of Directors of the Locomotive Appliance Company, held in their offices in the Old Colony Building, Chicago, Tuesday, January 2, Mr. H. M. Pflager, of St. Louis, was elected Director to fill the unexpired term of Mr. Edward B. Lathrop, deceased. Mr. W. H. England was elected Treasurer.

The Ingersoll-Rand Company states that it has secured exclusive control of the product of the Imperial Pneumatic Tool Company, with shops at Athens, Pa., including pneumatic hammers, drills, riveters, reamers, hoists and plug drills. The Ingersoll-Rand Company is also the maker of the Haeseler pneumatic tools.

The Telegraph Signal Co., of Rochester, N. Y., recently incorporated to make Wright's signal apparatus for the electrical control by the train despatcher of stop signals at stations along the road, is preparing to equip a shop in Rochester, where the apparatus will be manufactured. The device was recently tested at Liverpool, on the R., W. & O. division of the New York Central.

At the coming Chicago Electrical Trades Exhibition, the General Storage Battery Company, New York, will show, in addition to a full line of Bijur "High-Duty" plates and batteries, a working booster system handling violently fluctuating loads while maintaining a steady load on the generator. This will be accomplished by a "Bijur" automatic regulator working on a new principle, achieving results which will be well worth seeing.

The Dayton Pneumatic Tool Co., Dayton, Ohio, maker of "Green" pneumatic hammers, reports business for 1905 as having been most satisfactory. Notwithstanding the fact that there is a tendency toward the end of the year to delay purchases until after the beginning of the new year, an unusually large number of orders were received in December. The company has recently ordered additional machinery for its Dayton works which will increase the capacity to about 300 hammers a month.

For a number of years past B. M. Jones & Co., 141 Milk street, Boston, Mass., has existed as a partnership. The concern has now been incorporated under the name B. M. Jones & Co., Incorporated, with Benjamin M. Jones as President; James A. Warren, Vice-President and General Manager; Richard L. Thomas, Second Vice-President, and Walter J. Klein, Secretary and Treasurer. Mr. Jones is well-known as senior member of B. M. Jones & Co. Mr. Warren has for some time past represented the company in Chicago and Mr. Thomas in New York City. Mr. Klein has been with Mr. Jones in Boston for some time. Mr. Thomas, who is a member of the Finance Committee of the New York Railroad Club, was for some years with the National Lock Washer Co. of Newark, from which position he has just resigned, and has been identified with the railroad supply business for a long time. The new company will act as sole representative in the United States, Canada and Mexico for Samuel Osborn & Co., of England, makers of R. Mushet's "Special," "High-Speed" and "Titanic" steels and high grade tool steels, and will handle the Taylor Best Yorkshire iron for staybolts, axles, piston rods and crank pins for Taylor Bros. & Co., Ltd., of England. Mr. Warren will have headquarters in Chicago and Mr. Thomas in New York City.

Reconsignment of Hay at East St. Louis.

The Interstate Commerce Commission, in an opinion by Chairman Knapp, has announced its decision in the case of the St. Louis Hay & Grain Company against the Illinois Central and the Mobile & Ohio. The service of defendants in handling reconsigned hay at and from East St. Louis is found to be more expensive than the service performed in case of shipments through East St. Louis, while the privilege of reconsigning hay from that point at a charge

less than the established local rate is of substantial value to dealers in that city. The Commission decided that the fact that through rates are less than the sum of in and out rates is not of itself a valid ground of objection, nor is it unlawful for defendants to maintain reconsignment rates which are higher in some cases than their proportions of through rates; and also that the fact that the reconsignment rate is sometimes the same as the proportion of the through rate does not warrant an inference of illegal conduct or support a charge of unjust discrimination.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Southern and Southwestern Railway.

The next meeting of this club will be held in Convention Hall, Piedmont Hotel, Atlanta, Ga., January 18. Subjects for discussion are Cole Balanced Compound Locomotive, by G. M. Basford, and Steel Cars, by L. O. Cameron.

Canadian Society of Civil Engineers.

At the meeting of the Electrical section held January 4, a paper was presented on "A Burning Question—Defective Wiring." The Secretary announces that the annual meeting will be held in Toronto during the fourth week in January.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Annapolis, Washington & Baltimore.—The office of the President has been moved from Cleveland, Ohio, to Baltimore, Md.

Atchison, Topeka & Santa Fe.—William B. Jansen has been appointed Fourth Vice-President, in charge of accounting, the treasury, lands and fuel properties, with headquarters in Chicago. This is a newly-created position. Mr. Jansen is 38 years old, having been born in Chicago in November, 1868. He was educated in private schools in that city and finished at De Veaux Military Academy. His railroad career began in 1888 at Topeka, Kan., as a car checker in the local freight office of the Santa Fe. A few months later he was made a train collector and continued in that service for two years, when the train collectors were taken off. He then entered the operating department at Topeka as a clerk and advanced rapidly to the position of Assistant to the General Manager. He was transferred to Chicago in March, 1897, to become Secretary to the President, and in June, 1901, was made Assistant to the President. He will continue to discharge the duties of the last-named position in addition to those newly assigned.

W. B. Jansen.

Edward L. Copeland has been appointed Secretary and Treasurer, with office at Topeka, Kan., succeeding E. Wilder, deceased. Mr. Copeland was born in Winnebago, Ill., August 25, 1859. At the age of 20 he went to Topeka to take a position in the office of the auditor of the Santa Fe, and two years later was transferred to the treasurer's department. He was made Assistant Cashier in 1883, and in 1887 was promoted to Cashier, the position he has held up to the present time.

E. L. Copeland.

Chicago, Rock Island & Pacific.—W. M. Hobbs, Assistant to the Second Vice-President, has resigned, and the office has been abolished.

Denver & Rio Grande.—R. F. Watkins has been appointed Assistant Treasurer at Denver, Colo.

Iowa Central.—P. B. Seevers has been appointed General Claim Agent of this road and of the Minneapolis & St. Louis, with office at Minneapolis, Minn., succeeding M. Barr.

Midland Valley.—J. F. Holden, Freight Traffic Manager of the Chicago, Rock Island & Pacific, has been elected Vice-President of the Midland Valley, with office at Fort Smith, Ark., effective February 1.

Missouri & Illinois Bridge & Belt.—G. L. Ball has been elected Secretary, with office at St. Louis, Mo., succeeding E. D. Taylor.

Missouri & Louisiana.—W. C. Perry, General Attorney, has been elected also President, succeeding R. H. Keith.

Operating Officers.

Canadian Northern.—J. R. Cameron, Assistant Superintendent at Kamsack, Assin., has been appointed Superintendent at Port Arthur, Ont., succeeding W. A. Brown, promoted. J. Abbott has been appointed Superintendent at Battleford, Sask.

Chicago, Indianapolis & Louisville.—B. E. Taylor, hitherto Assistant to the President, has been made General Manager. The appointment comes after 26 years of varied experience in railroad service, mostly in the operating department. Mr. Taylor was born in Plymouth, Mich., in 1862, and began railroad work as a helper at the station in that town in 1879 on what is now the Pere Marquette Railroad. Having thus learned telegraphy, he filled positions as agent and operator at various small stations on the road, and also was a clerk in the general freight office. In 1884 he was sent to Milwaukee as cashier in the freight office, and in March, 1885, was transferred to the office of the Assistant General Freight Agent in Detroit. One year (1886-87) was spent in Florida on account of the health of a member of his family, and during that time he was chief clerk to the General Superintendent of the Florida Railway & Navigation Company. Returning north at the end of that time, he accepted the position of private secretary to the Receiver of the Wabash, but a few months later he entered the service of the Chicago, Indianapolis & Louisville as chief clerk to the General Superintendent. In 1896 he was made Purchasing Agent in addition to his other duties. In 1899 he was advanced to the General Manager's office as chief clerk. In 1903 he was made Assistant to the President and General Manager, the position from which he is now promoted to General Manager. He is also Secretary of the Indianapolis & Louisville, a subsidiary company of the Monon, and a director in the Consolidated Stone Company and the Indiana Stone Railroad, both Monon properties.

B. E. Taylor.

Chicago, Rock Island & Pacific.—The office of T. H. Beacom, Superintendent of the St. Louis division, has been moved from St. Louis, Mo., to Eldon, Iowa.

Indiana Harbor.—See Michigan Central.

Lehigh & New England.—H. C. Shields, Master Mechanic, has been appointed Superintendent, with office at Pen Argyl, Pa.

Michigan Central.—J. H. Snyder, General Superintendent of the Indiana Harbor, has been appointed Assistant General Superintendent of the Michigan Central, succeeding H. A. Worcester, promoted.

Minneapolis, St. Paul & Sault Ste. Marie.—G. S. Baxter, trainmaster at Gladstone, Mich., has been appointed Superintendent at Enderlin, N. Dak., succeeding C. F. Seymour.

Mississippi Eastern.—T. C. McWilliams has been appointed Superintendent, with office at Quitman, Miss., succeeding A. C. Schryver.

National Lines of Mexico.—A. Hulvershorn, Assistant Superintendent, has been appointed Superintendent of Express, succeeding H. P. Gallagher, resigned. J. E. Pettigrew succeeds Mr. Hulvershorn, both with offices at Mexico City.

Pittsburg, Allegheny & McKees Rocks.—J. V. Maher has been appointed General Manager, with office at McKees Rocks, Pa.

Southern.—F. J. Egan, Superintendent of the Mobile division, has been appointed Superintendent at Atlanta, Ga., succeeding W. N. Foreacre, promoted. J. H. Stanfiel, trainmaster at Knoxville, Tenn., succeeds Mr. Egan, with office at Selma, Ala.

Texas & Pacific.—J. B. Paul, Superintendent of the New Orleans division, has been appointed to the new office of General Superintendent of the lines in Louisiana and as far west as Marshall, Tex., with office at New Orleans. A. S. Wilson, chief train despatcher at New Orleans, has been appointed Assistant to the General Superintendent, with office at New Orleans. R. C. Andrews, assistant train despatcher, has been appointed Assistant Superintendent at Marshall, Tex.

Washington County.—J. Asnault has been appointed Superintendent, with office at Calais, Me., succeeding N. P. Baker, resigned.

Traffic Officers.

Chicago, Rock Island & Pacific.—J. F. Holden, Freight Traffic Manager, has resigned to go to the Midland Valley. Mr. Holden is succeeded by Harry Gower, Assistant Freight Traffic Manager. Mr. Gower was born in 1853 in England. He entered railroad service in this country in 1878 as clerk in the Auditor's office of the Chicago, Rock Island & Pacific, on which road he has remained ever since. In 1881, he was appointed chief clerk of the General Freight department, and in 1887, Second Assistant General Freight Agent. The next year, he became First Assistant General Freight Agent, where he remained until 1896, when he was appointed General Freight Agent. In 1899, he was appointed Assistant Freight Traffic Manager, from which position he is promoted to become Freight Traffic Manager.

H. Gower.

Cincinnati, Hamilton & Dayton.—W. B. Calloway, Assistant General Passenger Agent, has been appointed General Passenger Agent.

Erie.—C. W. Clarke, General Manager of the Erie Despatch, has been appointed General Freight Agent of the lines west of Buffalo and Salamanca, with office at Chicago, succeeding H. G. Krake, resigned.

Kansas City Southern.—F. D. Hunt is Industrial Agent, with office at Kansas City, Mo.

New York, New Haven & Hartford.—The office of E. L. Somers, Freight Traffic Manager, has been moved from Boston, Mass., to New Haven, Conn., and that of F. S. Holbrook, General Freight Agent, has been moved from New Haven to Boston. L. H. Kentfield has been appointed Assistant General Freight Agent, with office at New Haven.

St. Joseph & Grand Island.—H. W. Prickett has been appointed Assistant General Freight Agent, with office at Kansas City, Mo., succeeding W. N. Marshall.

Southern Indiana.—The office of H. P. Radley, General Freight and Passenger Agent, has been moved from Terre Haute, Ind., to Chicago, Ill.

Toledo, St. Louis & Western.—R. J. McKay, District Passenger Agent, has been appointed Assistant General Passenger Agent at St. Louis, Mo.

Engineering and Rolling Stock Officers.

Chicago & Alton.—G. H. Kimball, Chief Engineer, has resigned.

Chicago, Rock Island & Pacific.—N. D. Ballantine, Superintendent of Transportation of the Kansas City Southern, has been appointed Superintendent of Car Service of the C., R. I. & P.

Gulf & Ship Island.—A. Bardsley has been appointed Master Mechanic, with office at Gulfport, Miss., succeeding M. S. Curley.

Kansas City Southern.—See Chicago, Rock Island & Pacific.

Lehigh & New England.—F. S. Anthony has been appointed Master Mechanic, with office at Pen Argyl, Pa., succeeding H. C. Shields, promoted.

South & Western.—W. F. Steffens has been appointed Engineer of Bridges and Buildings, with office at Bristol, Va.

Tacoma Eastern.—E. D. Fletcher has been appointed Chief Engineer, with office at Tacoma, Wash., succeeding Henry Shaw.

Special Officers.

Kansas City Southern.—W. D. Lanier is Horticulture Agent, with office at Texarkana, Tex.

LOCOMOTIVE BUILDING.

The Michigan Central, it is reported, is in the market for additional locomotive equipment.

The Atchison, Topeka & Santa Fe has ordered 24 Atlantic (4-4-2) locomotives, 20 Santa Fe (2-10-2) locomotives, 11 compound Pacific (4-6-2) locomotives, and 25 six-wheel (0-6-0) single expansion switching locomotives from the Baldwin Locomotive Works. The Atlantic and Santa Fe locomotives are to be almost exact duplicates of those previously ordered by this road. The Pacific locomotives are for spring delivery, and will weigh 226,700 lbs., with 151,900 lbs. on the drivers; cylinders, 17 in. x 28 in.; diameter of drivers, 73 in.; wagon top boiler, with a working steam pressure of 220 lbs.; heating surface, 3,595 sq. ft.; 290 tubes, 2¼ in. in diameter and 20 ft. long; firebox, 108⅛ in. x 71¼ in., and tank capacity, 8,500 gallons of water. The switching locomotives are for April delivery and will weigh about 144,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,905 sq. ft.; 281 tubes, 2 in. in diameter and 12 ft. long; firebox, 102⅛ in. x 41¼ in.; grate area, 29 sq. ft.; tank capacity, 3,900 gallons of water, and coal capacity, eight tons. The special equipment for both includes: Westinghouse air-brakes, Gollmar bell ringers, Franklin boiler lagging for switching locomotives, Kewanee brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Tower couplers, Pyle-National headlights for Pacific locomotives, and Schroeder headlights for switching locomotives, Ohio injectors, Hewitt bronze journal bearings, U. S. piston and valve rod packings, Crane safety valves, Leach sanding devices, Chicago sight-feed lubricators, Simplex Railway Appliance Co.'s springs, Crosby steam gages and Standard Steel Co.'s wheel centers.

The Chicago & Alton has ordered 10 simple consolidation (2-8-0) locomotives, five simple Atlantic (4-4-2) locomotives, and 10 simple six-wheel (0-6-0) switching locomotives from the Baldwin Locomotive Works. The consolidation locomotives will weigh 207,000 lbs., with 185,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; crown bar boiler, with a working steam pressure of 200 lbs.; heating surface, 3,251 sq. ft.; 407 tubes, 2 in. in diameter and 14 ft. 4 in. long; firebox, 120 in. x 40¼ in.; grate area, 33.6 sq. ft.; tank capacity, 9,000 gallons of water, and coal capacity, 15 tons. The Atlantic locomotives will weigh 184,500 lbs., with 97,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 80 in.; crown bar boiler, with a working steam pressure of 200 lbs.; firebox, 120 in. x 40¼ in.; grate area, 33.6 sq. ft.; tank capacity, 9,000 gallons of water, and coal capacity, 15 tons. The switching locomotives will weigh 144,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; crown bar boiler, with a working steam pressure of 180 lbs.; heating surface, 1,947 sq. ft.; 324 tubes, 2 in. in diameter and 10 ft. 6 in. long; firebox, 120 in. x 42 in.; grate area, 35 sq. ft.; tank capacity, 4,000 gallons of water, and coal capacity, 15,000 lbs. The special equipment for all includes: Gollmar bell ringers, Keasbey & Mattison magnesia boiler lagging, Damascus brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Climax couplers, U. S. headlights for consolidation and switching locomotives, Pyle-National electric headlights for Atlantic locomotives, Monitor injectors, U. S. piston and valve rod packings, Crosby safety valves, Maryland inside sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Consolidated steam heat equipment for Atlantic locomotives, and cast-steel wheel centers.

CAR BUILDING.

The Erie is making inquiries in regard to 1,500 refrigerator cars of 60,000 lbs. capacity.

The Seaboard Air Line has ordered two coaches from the American Car & Foundry Co.

The Harriman Lines have ordered 600 refrigerator cars from the American Car & Foundry Co.

The Cleveland, Painesville & Eastern will probably order some new cars during the coming year.

The Evansville & Terre Haute has ordered 1,500 gondola cars from the American Car & Foundry Co.

The Barber Asphalt Company, it is reported, is about to build a number of extra heavy steel flat cars.

The Washington, Idaho & Montana has ordered 150 logging cars from the American Car & Foundry Co.

The Cincinnati, New Orleans & Texas Pacific has ordered one private car from the American Car & Foundry Co.

The Tidewater has ordered 300 stock cars and 100 flat cars of 80,000 lbs. capacity from the Western Steel Car Co.

The Colorado & Southern has ordered 1,500 box cars, 100 stock cars and 38 cabooses from the American Car & Foundry Co.

The Wabash & Rochester is figuring on the purchase of four gasolene motor cars and 10 freight cars of 80,000 lbs. capacity.

The Great Northern has ordered 10 combination mail and baggage cars, 10 baggage cars and eight mail cars from the American Car & Foundry Co.

The Mexican Central has ordered 50 additional tank cars from the American Car & Foundry Co. The specifications for these cars were published in our issue of September 8.

The Buffalo, Rochester & Pittsburg, as reported in our issue of December 29, has ordered 100 box cars, 200 drop-bottom gondola cars and 100 twin hopper gondola cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, as reported in our issue of January 5, has ordered 50 Hart convertible cars from the Rodger Ballast Car Co. These cars will be built by the American Car & Foundry Co.

The Nevada Northern, it is reported, will shortly be in the market for new equipment. A number of steel ore cars of 100,000 lbs. capacity will be included. Address the Nevada Consolidated Copper Co., San Francisco, Cal.

The St. Louis, Rocky Mountain & Pacific, as reported in our issue of December 29, has ordered two combination passenger cars and one first class coach from the American Car & Foundry Co., as well as 10 box cars and two cabooses.

The Toledo & Indiana, as reported in our issue of January 5, has ordered four interurban cars from the Jewett Car Co. These cars, including equipment, will weigh 70,000 lbs., and will measure 40 ft. long x 8 ft. 6 in. wide, inside measurements. The bodies will be of wood and the underframes will be of metal.

The Louisiana & Arkansas, as reported in our issue of January 5, has ordered 75 flat cars of 60,000 lbs. capacity from Barney & Smith for March delivery. These cars will be 40 ft. long and 9 ft. wide. The special equipment includes: Westinghouse air-brakes, More-Jones Brass & Metal Co.'s brasses, Tower couplers and American Continuous draft rigging.

The Solvay Process Company, as reported in our issue of December 29, has ordered 60 gondola cars of 90,000 lbs. capacity fitted with coke racks from the Middletown Car Works. These cars will weigh 36,000 lbs., and will measure 39 ft. 7 in. long x 9 ft. ½ in. wide x 3 ft. 7 in. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment will include: National-Hollow brake-beams, Westinghouse air-brakes, Ohio Bronze Co.'s brasses, Gould couplers, diamond trucks and Lobdell or Maryland Car Wheel Co.'s wheels. The coke racks will consist of stakes and planks forming an open rack 8 ft. 2 in. high from the top of car floor. The cars will be leased to the Delray Construction Railroad Co. and will be so marked.

The Southern has ordered 10,229 cars as follows: 1,572 gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co., for September, October and November, 1906, delivery; 1,157 hopper cars of 100,000 lbs. capacity from the American Car & Foundry Co., for October and November, 1906, delivery; 1,250 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co., delivery to commence in May, 1906, of from 18 to 20 cars per day; 3,000 box cars of 60,000 lbs. capacity from the Mt. Vernon Car Manufacturing Co., delivery to begin in March, 1906, and to be at the rate of 500 cars per month; 1,750 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for July and August, 1906, delivery, and 1,500 box cars of 60,000 lbs. capacity from the Lenoir Car Works, delivery to begin in March, 1906, at the rate of from 10 to 12 cars per day. The gondola cars will weigh 38,000 lbs., and will measure 41 ft. 9 in. long x 9 ft. 5 in. wide x 4 ft. 6 in. high, all inside dimensions. The bodies and underframes will be of steel. The hopper cars will weigh 36,000 lbs., and will measure 30 ft. long x 9 ft. 6 in. wide, inside measurements. The bodies and underframes will be of steel and they will be fitted with Dunham doors. The box cars will weigh 34,000 lbs., and will measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment for all the above cars will include: Steel axles; Bettendorf bolsters, except the hopper cars, which will be equipped with Simplex bolsters; Damascus brake-beams; cast-iron brake-shoes; Westinghouse brakes; Ajax plastic brasses; Major couplers; Jones doors for the box cars; Miner draft rigging; Harrison dust guards; McCord journal boxes; Lowe Bros. and Sherwin-Williams paint; Chicago-Winslow improved roofs; Railway Steel Spring Co.'s springs, and arch-bar trucks, except for 500 of the box cars, which will be equipped with Bettendorf steel trucks.

BRIDGE BUILDING.

Birmingham, Ala.—Jefferson County officials are locating the site for a steel bridge to be built over the Warrior river.

Chattanooga, Tenn.—At a recent meeting of the Board of Public Works, the opening of bids for the Eleventh street bridge was postponed until January 30. The extension of time was made to enable the contractors to bid on other plans for the bridge than those already prepared. City Engineer Hooke will have a new set of plans for a plate girder skew bridge ready shortly. The former plans call for steel truss structures with paved roadways and sidewalks.

Cincinnati, Ohio.—Plans, it is said, are being made for building a viaduct over Duck creek to cost about $75,000.

Council Bluffs, Iowa.—A bill is before the House of Representatives authorizing the Central Railroad & Bridge Company to build a bridge over the Missouri river at or near this place.

Des Moines, Iowa.—Plans are being made by George D. Dobson, of this city, for building a Melan arch over the Des Moines river at Locust street, to be similar to the one recently built on Sixth avenue.

Kansas City, Mo.—Announcement has been made by J. M. Gruber, General Manager of the Burlington lines east of the Missouri river, that this company will reconstruct the Hannibal bridge; build extensive freight terminals in Clay County, and a new freight house in the West bottoms during 1906.

Minneapolis, Minn.—Bids are wanted January 15 by Hennepin County Commissioners for repairing a number of bridges. H. R. Scott is County Auditor.

Haverhill, Mass.—Bids are wanted January 19 by the Commissioners of Essex County at Salem, Mass., for five spans of pin-connected steel trusses, 153½ ft. long, and one plate girder span 61 ft. long for a highway bridge over the Merrimac river at Haverhill, which is to have a roadway of 32 ft., with a sidewalk. James C. Hale is Clerk.

Pembroke, Ont.—Bids are being received by James Coxford for building a steel bridge with stone foundation over the Madawaska river, in the township of McNab (near Arnprior), in the county of Renfrew. Plans at office of James H. Smith, County Engineer, Pembroke, Ont.

Perth Amboy, N. J.—Contracts for the new iron drawbridge to consist of 17 deck girder spans on masonry piers to carry two tracks are reported let to McMullen & McDermott, of Philadelphia, Pa., for the sub-structure and to the Pennsylvania Steel Company for the metal work and machinery. The cost of the complete structure will be about $1,000,000.

Pine Bluff, Ark.—A bill has been introduced in the House of Representatives authorizing the Pine Bluff North & South Railroad Co. to build a bridge over the Arkansas river here.

Washington.—A bill has been introduced in both Houses of Congress authorizing and directing the Secretary of War to build a bridge across the Spokane river in the state of Washington.

Waupaca, Wis.—Bids are wanted January 16 by the Town Board for building a stone arch bridge over the Waupaca river. C. C. Boyce is Chairman of the committee.

Wenatchee, Wash.—On Jan. 4 a bill was introduced in the United States Senate and House of Representatives authorizing W. T. Clark to build a bridge across the Columbia river at this place.

Wingham, Ont.—Bids are wanted January 20 by John Ansley, County Commissioner, for building three steel bridges in Huron County.

Other Structures.

Brooklandville, Md.—A contract has been given to J. J. Walsh & Son by the Northern Central for putting up a brick passenger station two stories high to cost about $10,000.

Fairview, Pa.—The Pennsylvania, it is said, will begin work shortly on its new shop buildings at this place. During the present month work will be commenced on the car house, planing mill and store house.

Superior, Wis.—Announcement has been made that the Chicago

& North-Western will at once build a dock on the lake front here to cost about $600,000.

WAYCROSS, GA.—Announcement has been made by the Atlantic Coast Line that bids for new shops to be built at this place will by opened by R. E. Smith, Gen. Supt. Motive Power, at Wilmington, N. C., January 29. The proposed shops will cost $1,000,000, and are to be among the largest in the south, giving employment to about 1,200 men.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA & MISSISSIPPI.—It is said that this company, which operates 18 miles of railroad from Vinegar Bend, Ala., southwest to Leakesville, Miss., has extended its line in Green County, Miss., for a distance of 6 miles, and has projected an extension of 15 miles additional.

ALABAMA ROADS.—W. R. Sweeney and others, of Hopewell, Ala., and Tallapoosa, Ga., who own extensive saw mills in that section, will build a new line of railroad from Hopewell northwest to Edwardsville, in Cleburne County, thence south through Clay County to Montgomery, through a rich agricultural section, a distance of about 110 miles.

ASHEVILLE SOUTHERN.—A charter has been granted a company under this name in North Carolina to build a railroad five miles long on the east bank of the French Broad river. A. B. Andrews and other Southern Railway officials are interested in the new company.

BIG HORN (C., B. & Q.).—An officer writes that a contract has been let by this company to Guthrie & Co., of Garland, Wyo., for building an extension of its road from Frannie, Wyo., southeast to Worland, a distance of 91 miles.

BUFFALO & SUSQUEHANNA.—This company last year laid track on its line from Wellsville, N. Y., to Caneadea, and from Sandusky to Yorkshire, N. Y., also from Juneau, Pa., to Sagamore, Pa., a total of 53 miles. A connection between the sections of its road from Caneadea, N. Y., to Sandusky, and from Yorkshire to Buffalo is expected to be completed and in operation early next summer.

CENTRAL OF GEORGIA.—An officer writes that the Henry Ellen branch of this company is to be extended for a distance of 10½ miles to the Tunnel Coal Co. An extension is also being built from Greenville, Ga., north to Newnan, a distance of 24 miles. The contractors are Redmond & Gabbett, of Henry Ellen, Ala., and W. J. Oliver & Co., of Greenville, Ga.

CHESTERFIELD & LANCASTER.—This company, which operates 21 miles of railroad in South Carolina, has given a contract to O. H. Page & Son, of Cheraw, S. C., for extending its road from the present terminus at Ruby west to Lynches river, 18 miles.

CHICAGO & ALTON.—This company is building an extension of its road from Iles, Ill., southwest to Murrayville, 34.31 miles.

CHICAGO, BURLINGTON & QUINCY.—See Big Horn above.

CHICAGO, MILWAUKEE & ST. PAUL.—The contract for extending this road from Saranac, S. Dak., southeast to Colton, eight miles, and the White River Valley from Presho westward for a distance of 80 miles, has been let by this company to McIntosh Bros., of Milwaukee, Wis.

CHICAGO, ROCK ISLAND & PACIFIC.—See Rock Island, Arkansas & Louisiana below.

DEERING SOUTHWESTERN.—An officer writes that this company, operating six miles of railroad from Deering, Mo., has filed an amendment to its charter providing for an extension of its present line west to the Missouri-Arkansas state line. This calls for the building of about 11½ miles of track. The work will be done by the company's forces and will be completed during the next 15 months. The character of the work will be light. (December 8, p 183.)

DENVER, NORTHWESTERN & PACIFIC.—An officer writes that this company, which recently completed 34 miles of road from Arrow, Colo., to Sulphur Springs, has given contracts to Orman & Crook, of Pueblo, Colo., and to Dunphy & Nelson for building an extension from Sulphur Springs west to Toponas, an additional 68 miles. Surveys are also being made for a further extension from Toponas, Colo., west to Salt Lake City, Utah, 410 miles.

DURANGO CENTRAL.—Surveys have been made by this company for an extension from Descubridora, state of Durango, to Indo, about 100 miles. The line is through a rich mineral region that has been but little developed on account of lack of transportation facilities. Rails and other materials have been ordered.

ESQUIMALT & NANAIMO.—This company will apply to the Dominion Parliament for permission to extend its lines through Comax north to Campbell river; also to build branches from Duncan's via the valley of the Cowichan northwest to Alberni and a branch from some point near Englishmen's river to Alberni canal or a branch from Comax via Cumberland southwesterly to the Alberni canal.

GAINESVILLE MIDLAND.—This company has let a contract for extending its road from Jefferson, Ga., southeast to Athens, a distance of 18 miles.

GRAND RAPIDS TERMINAL BELT.—This company has filed articles of association with the Secretary of State at Lansing, Mich., with a capital of $100,000, to build a belt line around Grand Rapids, connecting five of the railroads. Rights of way have been practically secured. Such a road will greatly facilitate the handling of freight in carloads. The construction of the new road is not to interfere with the laying of double tracks from Wealthy avenue to Mill Creek by the Grand Rapids & Indiana and the Pere Marquette railroads. This work is already under way. A meeting of the new company will be held in January, when officers will be elected and plans arranged. The following names appear in the articles: James A. Hamler, St. Louis; Edward A. Wescher, St. Louis; Thomas A. Whitmore, Chicago; Edward H. Christ, Grand Rapids, Mich., and Jacob Kleinhans, Grand Rapids, Mich.

GREEN RIVER VALLEY (L. & N.).—This company is making surveys, and, it is said, will ask for bids by April 1 for building its proposed road from Stamford, in Lincoln County, Ky., on the Louisville & Nashville, southwest to Scottsville, in Allen County, on the Chesapeake & Nashville, a distance of 100 miles. This project has been under consideration for several years. When completed the road will form part of the L. & N. system.

HOLSTON RIVER.—Incorporation has been granted this company in Tennessee with a capital of $100,000 to build a railroad from Rogersville, Tenn., northeast to Bristol, on the Tennessee-Virginia State line, a distance of 45 miles. The officers are: James B. Wright, President; J. H. Frantz, Vice-President, and Howard Cormick, Secretary and Treasurer, all of Knoxville.

KANSAS CITY, TULSA & SOUTHWESTERN.—An officer writes that this road, which was incorporated last year to build and operate a railroad from Kansas City, Mo., to Wichita Falls, Tex., is making surveys from Joplin, Mo., to Tulsa, Ind. T., a distance of 126 miles. W. H. Hendren is Chief Engineer, Tulsa, Ind. T.

LOUISVILLE & NASHVILLE.—See Green River Valley above.

MEXICAN ROADS.—A concession has been granted by the state government of Oaxaca to Charles A. Hamilton, President of the San Juan Taviche Mining Co., and work is to be started shortly on a railroad from Ocotlan to San Geronimo Taviche, a distance of about 17 miles. The road will be narrow gage and the work will be easy, as it passes through a level section, with the exception of five miles. Surveys have all been completed.

A concession has been granted by the Mexican Government to John Henderson to build a railroad from Port Lobos to the town of Caborca, in the state of Sonora. Surveys are to be begun within six months. Six miles must be completed within 18 months, and a similar length completed each year until the road is finished, which will take about six years. The office of the company will be at Nogales, which is the terminus of the Guaymas Railroad. Port Lobos is south of Guaymas, and Caborca is in the southern section of the Altar district. The line will be southeast of and parallel to the Guaymas & Nogales road.

MIDLAND VALLEY.—An officer writes that this company, which recently completed 58 miles of its road to Foraker, Okla. T., has given contracts to Kalmann & McMurray, of Kansas City, and to Maney Bros., of Oklahoma City, for building an extension of its road from Foraker northwest to Silverdale, Kan., a distance of 29 miles.

NEVADA NORTHERN.—This road is to be finished by next April, we are informed; and 20 miles of track is already laid. The company was incorporated to build a railroad from Toano, Nev., on the main line of the Southern Pacific, south to Ely, a distance of about 140 miles, and it has let the contract for the entire road. Grading has been finished for 80 miles. The road is being built by the Nevada Consolidated Copper Company, of San Francisco, to carry ore from its mining works to be built at Ely. The cost of the road will be about $2,000,000. C. B. Beatty is Superintendent, and A. Judell Chief Engineer.

NEW JERSEY ROADS (ELECTRIC).—Chicago capitalists have completed negotiations with William J. Thompson, of Gloucester City, for the right of way, said to be owned by him, for a railroad from Gloucester City to Atlantic City, N. J. The cost of building a road between these places will be about $6,000,000.

NIAGARA, ST. CATHARINES & TORONTO (ELECTRIC).—Application will be made to Parliament by this company, operating 12 miles of

electric roads in Ontario, for permission to extend its line from Thorold south to Port Colborne, thence east to Fort Erie and north to Niagara Falls, from Niagara Falls north to Niagara-on-the-Lake; also from Niagara Falls to Brantford, and from St. Catharines to Niagara-on-the-Lake. Permission will also be asked to absorb any company having similar powers.

OKLAHOMA WESTERN.—A charter has been granted a company under this name in Oklahoma with authorized capital of $8,000,000 to build a railroad from Pawhuska, in the Osage nation, via the Middle Saline reservation, in Woodward County, and Kenton, in Beaver County, to a point in Union County, N. Mex., passing through the Osage and Kaw reservations and the Counties of Pawnee, Kay, Noble, Garfield, Grant, Woodward and Beaver, a total distance of 450 miles. The incorporators are: W. Graham, Paul D. Howse, Sidney H. Selig and others, of Chicago, and John A. Stine, H. A. Noah and others, of Alva.

OREGON & SOUTHEASTERN.—This company, which operates 16 miles of railroad in Oregon, has completed surveys for building an extension from Eighteen-Mile Post to Bonita, a distance of 10 miles.

ROCK ISLAND, ARKANSAS & LOUISIANA.— (C. R. I. & P.)—An officer writes that this company has given a contract to Craney, Dalhoff & Peters for the grading, track laying and bridge work at Little Rock, Ark., and to Collins Bros., of Rock Island, Ill., for work on the proposed extension from Haskells, Ark., southeast to Crossett, a distance of 107 miles, with a branch from Summerville southwest to Eldorado, an additional 36 miles. The company has completed 35 miles from Haskells toward Fordyce.

SHREVEPORT & NORTHEASTERN.—This company, which has projected a road from Shreveport, La., via Homer to Memphis, Tenn., has surveys completed from Shreveport to Homer, and has secured the right of way. A contract has been let to A. Kinnebrew & Co., of Homer, and grading has been completed for about 18 miles. (November 17, p. 160.)

SOMERSET.—An officer writes that this company, which recently completed 10 miles of road from Deadwater, Me., to Lake Moxie, has given a contract to J. G. White & Co., of New York, for building a line from Lake Moxie to Kineo, a distance of 33 miles.

STONEVILLE & SOUTHWESTERN.—Application has been made by a company under this name in Mississippi to build a railroad from Stoneville, in Washington County, Miss., southwest to a crossing with the Yazoo & Mississippi Valley, thence southwest through Issaquena County to Ben Lomond, on the Mississippi river, about 50 miles. The incorporators are: R. W. Carington, F. H. Icy and C. A. Douglas, all of Leeland.

SUSQUEHANNA & NEW YORK.—This company is making surveys for grade revision on its line from Short Run, Pa., northeast to Ellenton, a distance of eight miles.

TENNESSEE.—An officer writes that contracts have been let by this company to Eskridge & Carroll, of Huntsville, Tenn., and Burgin, Carson & Co., of Pioneer, Tenn., for extending its road from Buffalo creek, Tenn., to Smokey creek, a distance of 18 miles.

TIDEWATER.—The MacArthur Bros. Co., which has the contract for building a portion of the Tidewater-Deepwater railroad, has sublet contracts for a part of the work through Virginia and West Virginia as follows: Mason, Hanger, Coleman Company, Frankfort, Ky., grading and tunnel, $250,000; P. J. Millett, Paris, Ky., bluff work, $250,000; D. J. McDonald, Aurora, Ill., grading, $225,000; Mike Elmore, Alliance, Neb., grading, tunnel and bluff work, $600,000; Bates & Rogers, Chicago, masonry, $300,000; James Hearn & Co., Ada, W. Va., grading, $65,000; W. N. Camp & Co., Roanoke, Va., grading, $100,000; Carpenter & Boxley, Clifton Forge, Va., grading and tunnel, $377,000; Chill & Purnell, Eggleston, Va., bluff work, $100,000; J. C. Zobrist & Co., Roanoke, Va., grading, $60,000; Ingles & Shelburne, East Radford, Va., grading, $70,000; W. H. Johnson, Salem, Va., part of section 263, all of section 264 and part of section 265, grading; Litz & Co., Graham, Va., sections 359 to 362, grading and tunneling. A contract for bridges and a mile-long trestle has also been let to the Virginia Bridge & Iron Company.

TONOPAH & GOLDFIELD.—An officer writes that this company, which recently completed 35 miles of road from Tonopah to Goldfield, Nev., is making surveys for a further extension from Goldfield southeast to Bullfrog, an additional 80 miles.

TONOPAH & TIDEWATER.—This road, which was incorporated last year to build from Ludlow, Cal., has filed a description of its route as follows: From Ludlow north through Amargosa canyon and Inyo County to Bullfrog, Nev., 158 miles, with a branch from a point in Inyo County to Borax mine, in Death Valley, 7½ miles. F. M. Smith, of Oakland, Cal., is the promoter.

WAYNESBURG & WASHINGTON.—Announcement has been made that this company, which at present operates a narrow gage road 29 miles long from Washington, Pa., south to Waynesburg, will be changed to standard gage and an extension built south to Dotysburg and eventually to West Virginia. Surveys for the proposed extension have been completed.

WHITE RIVER VALLEY.—See Chicago, Milwaukee & St. Paul above.

RAILROAD CORPORATION NEWS.

ARIZONA & UTAH.—This road, which runs from McConnico, Ariz., to Chloride, 22 miles, has been sold by the receiver under a judgment of $452,000 granted to the Atchison, Topeka & Santa Fe, which owns all the stocks and bonds.

ATLANTA, BIRMINGHAM & ATLANTIC (ATLANTIC & BIRMINGHAM.)—This company has filed a mortgage for $30,000,000 in favor of the Old Colony Trust Co., of Boston.

BOSTON & LOWELL (B. & M.)—The stockholders have authorized an issue of $500,000 4 per cent. 20-year refunding bonds to take up $500,000 of 4 per cent. bonds maturing November 1, 1906.

CRIPPLE CREEK CENTRAL.—The directors have declared a quarterly dividend of 1 per cent. and an extra dividend of 1½ per cent. on the $2,500,000 common stick, payable January 17. The last dividend on the common stock was 3 per cent. in October. The regular quarterly dividend of 1 per cent. on the preferred stock was also declared.

HUDSON VALLEY.—A circular has been issued to security holders of this company asking their consent to a reorganization of the company, which, the committee points out, is absolutely necessary. It is proposed, in addition to the existing 5 per cent. consolidated mortgage bonds amounting to $4,000,000 and $3,000,000 of common stock, to issue $500,000 of 5 per cent. non-cumulative debenture A bonds and $2,500,000 of 2 per cent. debenture B bonds. It is provided that after two years the B debentures may be converted into 5 per cent. non-cumulative preferred stock. The holders of present consolidated bonds are asked to surrender to the treasurer of the company 20 per cent. of their holdings of these bonds, and to accept for the same an equal amount of debenture A bonds. The holders of Hudson Valley demand-notes outstanding to the extent of $222,125 are asked to accept an equal amount of debenture B bonds. The Hudson Valley Railway Company trust notes amounting to $30,000 will be paid off in cash to be provided by the sale of debenture B bonds at 30. It is proposed to sell at this price $1,500,000 of these bonds, which will supply $450,000 in cash, which will be used to liquidate floating debt and for general improvements. The present common stock, according to the plan, is to be put in a voting trust for five years, the trustees named being John W. Herbert, E. Clarence Jones and James H. Caldwell.

MOBILE & OHIO.—The bill passed by the last session of the Mississippi Legislature legalizing the merger of the Mobile & Ohio and the Southern has been vetoed by the Governor of the State. It is understood that no effort will be made to pass the bill over this veto.

NEW YORK CENTRAL & HUDSON RIVER.—The statement for the quarter ended December 31, partly estimated, shows gross earnings of $23,272,200, an increase of $2,187,223, and net earnings of $6,252,200, an increase of $230,190. The partly estimated figures for the year ended December 31 show gross earnings of $85,849,600, an increase of $7,276,391, and net earnings of $24,592,900, an increase of $2,142,076; surplus after dividends, $2,163,600, an increase of $1,221,361.

NEW YORK, NEW HAVEN & HARTFORD.—The outstanding 5 per cent. 20-year gold bonds of the New Haven Steamboat Co., of which $349,000 were issued, will be redeemed at the office of the Treasurer of the N. Y., N. H. & H. on February 1, 1906, at $105 a share.

OTTUMWA RAILWAY & LIGHT.—This company has been incorporated with $1,000,000 common stock and $500,000 preferred stock to take over the property of the Ottumwa Traction & Light Co.

ROCK ISLAND, ARKANSAS & LOUISIANA.—The stockholders have authorized an issue of $15,000,000 bonds. One-half of this is to be issued soon, and will be used to refund the $1,260,000 bonds outstanding and to liquidate other construction debt. (November 24, p. 166.)

SOUTHERN.—See Mobile & Ohio.

TOLEDO RAILWAY & TERMINAL.—Judson Harmon has been appointed Receiver.

UNITED RAILWAYS INVESTMENT COMPANY.—A stockholders' meeting has been called for January 31 to vote on the proposed increase of common stock from $10,000,000 to $25,000,000. Part of the new issue is to be used to pay off the $900,000 back dividends on the preferred stock. This company owns all the stock of the United Railroads of San Francisco. (See Philadelphia Co., December 1, p. 176.)